ENGINEERING NEWS

THE West Point Tunnel repairs are progressing slowly. The removal of the débris where the great cave-in of the roof occurred is attended with danger to the workmen in the form of fresh falls of earth and rock, and has to be carefully done. As the work advances the reconstructed tunnel is made secure by steel arched ribs.

The repairing gangs work in shifts in each approach night and day, but only 15 men can find room to work together. The repairers have not as yet succeeded in digging out the two cars loaded with passengers, baggage and express goods that were caught and crushed when the cave-in occurred. Those in charge of the repairs say that it will take nearly a month's work to reopen the tunnel for traffic.

THE NEW CROTON AQUEDUCT COMMISSION resolved, on Oct. 19, to instruct the City Comptroller to pay to the firm of O'Brien & Clark the face of their estimates as returned by the Chief Engineer, withholding the amount of $75,684 certified as the amount necessary to make good defective work on Sections 6, 7, 8 and 9 of the new aqueduct, and to thus leave the over payments, advised by the City Counsel to be sometime deducted, to be adjusted when the work is finally completed. The Comptroller now holds $630,000 of retained percentage of this firm; an amount that exceeds the sum in dispute by over $350,000. A resolution of the day previous, relating to the contract of Brown, Howard & Co. on Sections 2, 3, 4 and 5, advised the withholding of $126,223, the amount certified by the Engineer as necessary to repair defective work, and the further sum of $124,417.83, a part of the amount overpaid to the contractors. With these exceptions the face of the estimate is to be paid as returned, and the settlement of the remainder of the overpayment is to be adjusted when the work is completed. The Comptroller now holds $731,405.61 of the retained 10 per cent. of this firm.

THE Philadelphia water supply being contaminated at frequent points by sewage, Engineer EMILE GEYELIN, well known for his connection with hydraulic machinery, has published a pamphlet advocating the intercepting of all sewage in the Schuylkill river for 20 miles above the city, and the filtration or chemical treatment of all water supplied to Philadelphia. He estimates that the intercepting of the sewage will only require the handling of 2,500,000 galls. in 24 hours. This with all necessary plant would cost about $700,000. The three filter plants are estimated to cost $400,000 more; making the total annual cost of intercepting and filtering $106,000, for a population twice as large as at present.

THE CHILIAN RAILWAY CONTRACT, now definitely secured by the American syndicate represented by Messrs. COMEGYS & LEWIS and the Union Bridge Co., covers the construction of about 780 miles of railway in Chili, a system more fully explained in our letter of this week from Col. S. H. LOCKETT, who was one of the engineering commission sent down to examine the proposed routes. The price is not stated, but it exceeds the $35,000,000 originally appropriated for this work by the Chilian Congress.

FOREST destruction is in order in California, as the result of the purchase by a San Francisco syndicate of 625 sq. miles of timber land owned by the Central Pacific R. R. Co. This tract is densely covered with large sugar pine trees. It lies west of lake Tahoe in the northern part of El Dorado Co., and has been left intact owing to the lack of transportation facilities. But the present company proposes to build a flume to Folsom, 50 miles distant, and spend about $1,000,000 in thus opening to a market one of the most magnificent timber tracts in California.

THE irrigation of New Mexico is strongly recommended by Gov. Ross in his last annual report. He says that outof the 79,000,000 acres comprising the area of this State, 60,000,000 acres may be classed as tillable with sufficient irrigating facilities, which can only be secured by storage reservoirs as contemplated in Maj. POWELL'S report and for which the survey is now in progress.

THE Clyde shipbuilding industry continues brisk and the year's output promises to be greatly in excess of that for 1887.

THE Wason car works have just finished a parlor car and passenger coach of American types for one of the railroads of Portugal. They are to be run on the line to practically test the peculiar advantages of the American car, with a view to ordering others if they are found suitable.

A SERIOUS GRADE CROSSING ACCIDENT occurred on the Union Elevated Railway, Brooklyn, N. Y., on Nov. 6. The Myrtle Ave. line, and the line from the Brooklyn Elevated road to Flatbush Ave. cross at grade at Myrtle and Hudson Aves., and accidents have been predicted ever since the crossing was decided upon. The engineers cannot see approaching trains on the other road on account of the houses, and they are dependent upon the signals, which were claimed to be thoroughly efficient. The Hudson Ave. line was only opened to traffic on Monday, and on Tuesday the first accident occurred; both trains are said to have been running at the usual speed; one engine was wrecked and was nearly knocked off the elevated structure. Traffic was blocked for 24 hours. A fireman was seriously injured. A grade crossing on an elevated line, whether it be a complete one, or only a partial one due to junction of double tracks, must ever be a most objectionable feature, although the one at Chatham Square has been managed with remarkable success, giving hope that with adequate care, and with the slow speed of elevated trains (especially when there is a station at the crossing) no serious disasters may result. Derailing switches are hardly available for elevated lines; but that there is no absolute safety without them on surface roads is well illustrated by this accident.

BRIDGE ACCIDENTS are reported as follows: The India Point bridge of the Providence, Warren & Bristol Railway, near Providence, R. I., was badly damaged, Nov. 3, by being run into by a barge. Trains were not able to pass until repairs had been made.——At Rome, Ga., a newly erected wooden highway bridge over Horseleg creek, built partly of timbers from an old bridge, collapsed and was entirely wrecked.——One of the bridges over the Don river in the Todmorden valley, near Toronto, Ont., collapsed recently under a heavy wagon load of stone; the wagon, men and horses went down 30 ft. into the shallow bed of the river. Nobody was injured.

ANOTHER BRIDGE ACCIDENT is described as follows by the Newark N. J., *Advertiser*, of Nov. 5:—"The new county bridge over the Second river at Brighton avenue, in Doddtown, was completed yesterday and the timbers were removed from under the arch. They had hardly been taken out when, the whole structure fell into the stream. A number of men who were working under the bridge at the time barely had time to escape with their lives. The contractor, E. J. CODDINGTON, lays the blame for the accident on the engineer, as the arch, which had a span of 30 ft. was so flat that it could not sustain its own weight. He says that he protested against the plan of the bridge, but was instructed to go ahead. As the work was inspected as it progressed, and no fault of construction is alleged, the loss will probably fall on the county."

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a collision Nov. 3 between a Michigan Central express and a Lake Shore switch engine at Toledo, O. Both engines were wrecked; five men were badly injured, two of them fatally. The accident is said to have been the result of gross carelessness on the part of the men on the switch engine, who state that they had *forgotten* about the express and were running down the main track to a lower switch.

A CYCLONE struck Laporte, Ia., Nov. 1, and did damage to the amount of $50,000.——The bank of the Cornwall canal has continued to settle and another crack has been discovered.——A portion of a tunnel on the East Tennessee, Virginia & Georgia, between Atlanta and Rome, Ga., caved in Oct. 29.

A RESERVOIR at Montreux, on the lake of Geneva, Switzerland, used to drive the plant of an electric railway, burst on Nov. 6, doing considerable damage. Several persons were drowned.

THE Pennsylvania Railroad elevated tracks, in Jersey City, are actually commenced, after many months delay due to local political squabbles. The Pennsylvania Railroad has commenced on the foundations and piers for a four-track elevated road down Railroad Ave. The estimated cost is $1,000,000 and it will take about one and one-half years to complete it. The plan of structure proposed was illustrated in our issue of June 25, 1887.

THE London *Railway News* says that the stockholders of the Hudson River Tunnel Railway Co. have elected Messrs. GAGER, FORCE, ABBOTT, PERKINS, WELLING, WHITE and GIBBS as a board of directors. The *News* further states that work will be commenced "as soon as capital is furnished by the English syndicate interested in the project."

INDIAN RAILWAYS increased 1,204 miles during 1877, to 14,068 miles, the additions being largely of frontier military railways. The earnings fell off about 3.9 per cent. The average cost per train mile is about 90 cts., 1,857 miles are now under construction by the State, 449 miles by native States, and 181 miles by guarantee, assisted and other companies, *none* being business enterprises pure and simple. The Government lines only have lost nearly $5,000,000, including payment into the sinking fund.

THE BUFFALO TERMINAL IMPROVEMENTS, we are pleased to learn, are likely to go through in good shape after all, and the excellent plan devised by Mr. BUCKHOLZ carried out. The reports to the contrary arising from the statements made at the late Buffalo conference, are unduly unfavorable.

AN IRON TIE EXPERIMENT is to be made by the New York Central, which has placed a contract for 800 ties. They will be laid on the new Harlem tracks.

THE HUDSON SUSPENSION BRIDGE & New England Railway Company has let contracts for approaches to its proposed bridge across the Hudson river at Fort Clinton, near Peekskill, N. Y.. as announced in a letter from the company in our columns of railroad news.

THE BROOKLYN BRIDGE was obstructed by a derailment in the midst of a rush of political traffic Nov. 3 by the derailment of the rear truck of a four car train on the sharp switches at the New York end, causing a temporary blockade. The cable was stopped, and until the derailed car could be replaced, one four-car train was pulled and shoved by locomotives over the south track.

IMMIGRATION is still falling off. The comparative figures are

	1888	1887
Month of September	39,865	48,443
3 mos. ending Sept. 30	116,594	124,831
9 " " "	432,802	411,282

The decrease is chiefly in Swedes, Italians, Germans and Hungarians. From Great Britain the immigration has fallen off little, being now about 43 per cent. of the whole.

THE NEW YORK STEAM HEATING LAW went into effect last week. Ten companies were granted an extension to Jan. 1, 1889, and one company an extension for a year, but all the others are conforming or on the point of conforming to the law. The indications are that about *one-eighth* of the aggregate of 20,582 passenger cars in use in the United States are now equipped to heat by steam; and if we deduct from this aggregate about 3,000 cars in the southern States, where the climate and the traffic make this reform less urgently important, this showing is a very gratifying one. By the end of another year we shall expect to find fully one-half of the cars in use so equipped.

UNDERGROUND RAILWAYS are recommended for Philadelphia in a lecture on this subject by Prof. L. M. HAUPT, at the Franklin Institute. Prof. HAUPT especially devoted himself to the consideration of the Reading Railroad terminals, and denied the statement of the Reading engineers that an underground plan was impossible on their lines in the City. He supported his position by maps and cross-sections and argued that such roads were feasible and under existing conditions the best adapted to the needs of Philadelphia.

The Proper Relation to Each Other of the Sections of Railway Wheels and Rails.

[Preliminary Report of the Committee on this subject to the American Society of Civil Engineers.]

(*Continued from page 343*).

THE CAUSES OF SHARP FLANGES.

The following causes are all admitted to have an effect on sharp flanges, besides or in addition to, the effect of the form of the rail which is under discussion.

First.—Difference in diameter of wheels.

Second.—Trucks out of square.

Third.—Bad quality of wheels.

Bad gauging of wheels, unequal loading, etc., etc., are also admitted aggravating causes.

While the existence of these defects is undoubted, often in an aggravated degree, yet there is a possibility which demands consideration, that they may produce sharp flanges when the rails are sharp cornered, and not produce them when the rail section fits the fillet of the flange. In view of the preceding conclusions as to the great comparative life of sharp-flanged wheels, if they be admitted to be correct, the question loses much of its importance, yet as those conclusions may not be admitted, it appears desirable to examine the probable effect of each of the above causes on sharp flanges.

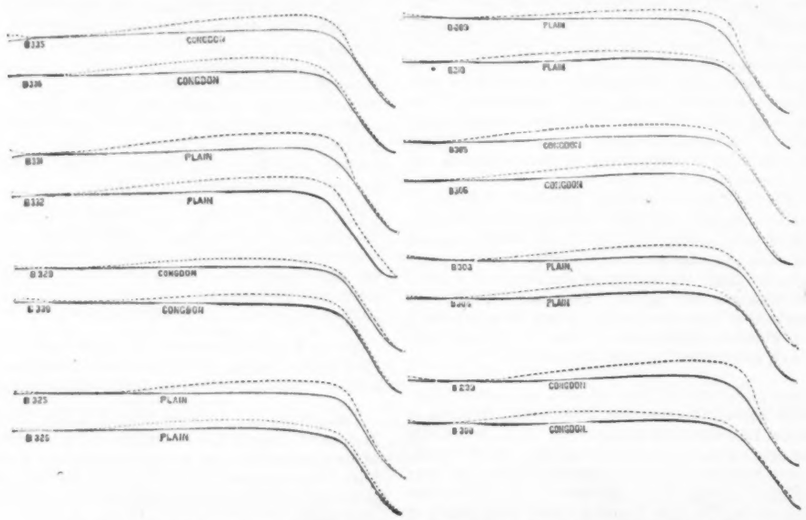


Fig. 3, Illustrating the Comparative Wear of Opposite Wheels on the Same Axle.

This cut consists of a series of diagrams, reduced to two-thirds of the original size, prepared by Mr. J. TOWNSEND, General Foreman Car Department, Chicago & Alton Railroad, for the Congdon Brake Shoe Co., to illustrate the effect of that device, and not with any reference to flange-wear. He says in regard to the sections:

"The diagram shows the wear of eight steel-tired wheels under Chicago & Alton Baggage Car 40, which was put into service Nov. 11, 1883, also diagrams of eight steel-tired wheels under Baggage Car 43, which was put into service Nov. 12, 1883, both cars and wheels being new.

"On the wheels of each car, four Congdon shoes and four common shoes were applied, accurate templates being made at the time, and number of each wheel taken on which the shoes were placed, and is shown in diagram by the plain line.

"At the expiration of six months, the cars having been in constant service between Chicago and St. Louis, accurate templates of the wheels were again made, which are indicated by the dotted lines in the diagram, thus showing the exact wear of the wheels on which were placed the Congdon as well as the common shoes."

DIFFERENCE IN DIAMETER OF WHEELS.

It is probable that few cast-iron wheels, mated on one axle, are exactly of the same diameter or exactly round. In not a few cases they are slightly out of center. In others they are of different hardness, so that if of originally the same diameter, they do not remain so. In others, again, the tread wears irregularly, so that the diameters are different in one position, although the same in another. In much less degree these conditions obtain with tired steel or dressed cast wheels. Great carelessness is often shown in mating wheels.

Mr. M. N. FORNEY, in the paper before referred to, demonstrates by results of experiments made with models, that even in a rectangular wheel-base, if the wheels are of different diameters, there is always a tendency to run in a curve. This tendency becomes very slight when the wheel-base is long, especially when the difference of diameter is small, but it always exists. Mr. A. M. WELLINGTON, of your committee, has repeated these tests with a differently constructed apparatus, now in the possession of the Society, with the same result. If the wheels of only one axle are of different diameter, while the wheels of the other axle are of equal diameter, it is probable, although not demonstrated, that the tendency to run in a curve will be aggravated, for reasons which will be obvious on consideration.

Whenever there is the slightest difference in the diameter of the wheels, therefore, there will exist a tendency to roll toward one rail, which must be continuously resisted by the flange; in other words, the flange reaction must continuously slide the wheels laterally on the rails. The power, or energy, wasted thereby will vary with the distance slidden through in a given time, and will ordinarily be trifling, but the flange pressure or reaction will not vary, since it takes the same pressure in pounds to slide a body an infinitesimal distance as to slide it a greater one; or even a greater pressure, because of the higher coefficient of friction.

There must, therefore, on both curves and tangents, be a large proportion of wheels which are exerting a very considerable flange pressure against the rails. How large a proportion it would be impossible to estimate statistically, but this cause for running to flange is aggravated by another, which can be rudely estimated.

TRUCKS OUT OF SQUARE.

It appears almost self-evident, although your Committee are not aware that it has been demonstrated, that a truck out of square will have a tendency to run to flange even if the axles are parallel. If the axles are not parallel, there will certainly be such a tendency. To fit the axle to run in a 1° curve they need only be $\frac{1}{16}$ of an inch out of square. Car trucks, especially for freight, are often rudely made, without much attempt at more minute precision than this, and the statistics gathered by your Committee afford some measure of the resulting tendency to run to flange in the difference in number of sharp flanges in the freight trucks and passenger trucks.

On the Pennsylvania Company lines (Pittsburg, Fort Wayne & Chicago) the percentage of sharp flanges in worn out wheels only, is only 11 per cent. in passenger against 20 in freight. On the Chicago, Burlington & Quincy, percentage of all removals, the figures are 6.4 passenger against 21.5 freight. The high percentage given for steel-tired passenger wheels (47.3) may be thrown out of account for our present comparative purpose, for reasons given in the letter of GODFREY W. RHODES, Superintendent M. P., subjoined to this report.

Other accompanying data, although not so directly comparative, afford cumulative evidence to the general fact, which is all your Committee can attempt to establish, that with all other conditions approximately equal, a much larger percentage of sharp flanges results in freight trucks than in passenger trucks.

It is probable that from the continued effect of irregular diameters and trucks out of square, a very large proportion of the wheel are subjected to a tendency to run to flange or away from flange; perhaps nearly all of them, and certainly a much larger proportion than finally obtained sharp flanges, so that one or the other defects is the first provoking cause of all sharp flanges. That this is so is clearly indicated by another fact of great importance in relation to this question, which we may now establish that with very rare exceptions sharp flanges occur only on one axle and are mated with wheels which wear away from flange.

If then other causes combine, such as bad quality, bad chill in the fillet, sharp cornered rails or what not, a sharp flange results; otherwise not. After establishing the fact just noted we will proceed to estimate the light which statistics shed on each of these latter causes.

SHARP FLANGES OCCUR IN ONE WHEEL ONLY.

So far as your Committee can ascertain, it is practically an invariable rule that only one wheel on the axle has a sharp flange, and by far the most common rule that the opposite wheel is worn away in the tread from flange Fig. 3, selected by mere chance as the first example of a series of worn sections which came to hand, and made to decide an entirely different question from that now under consideration, illustrates this fact sufficiently well. Out of the sixteen sections shown there are five which show some tendency to wear to flange. In every case the other wheel on the same axle shows an equally marked tendency to wear away from flange.

At the 1883 Master Car Builder's Convention, Mr. RICHARD WILLIAMS, an English mechanical visitor whose experience had been such as to entitle his opinion to respect, declared as a part of a quite extended discussion, "I defy any of you to say you ever saw two sharp flanges on the same axle," and no one took up the challenge except one member, who suggested that the claim was a little too sweeping. In a paper signed C. E., written by Mr. A. M. WELLINGTON, of your Committee, and published in the *Railroad Gazette* of March 27, 1885, this language was quoted, and it was added; "Modifying Mr. WILLIAMS' challenge so as to except wheels which have rendered full mileage before condemnation, the chances are strong that not a single instance can be found anywhere. Certainly, the exceptions are so rare as merely to prove the rule."

This challenge was taken up in a following issue of the *Railroad Gazette* (April 10), by Mr. R. H. FOWLE, an Inspector of the Pennsylvania Railroad at the Jersey City shops, in which he stated that he "found that two sharp or worn flanges on the same axle are very common," alleging that he had found two cases in a single lot of 70 wheels, but this assertion was in turn controverted, May 8, 1885, by Mr. J. N. BARR, Mechanical Engineer (now Superintendent of Motive Power, of the Chicago, Milwaukee & St. Paul Railway in the following words:

"I was very much surprised at the remark made by a correspondent in the *Railroad Gazette* of April 10th, who says 'two sharp or worn flanges on the same axle are very common,' the same apparently being the result of experience on the Pennsylvania Railroad. The following rule has long been in force on this road and on several others with regard to using second-hand wheels which are good for further service: 'Wheels showing a tendency to wear at the flange should be mated together; also wheels showing a tendency to wear away from the flange.' Are not the wheels referred to some that have made a second run and that have been remated in accordance with the above rule?

"As a matter of fact, I would say, after having made this particular point one of careful observation for ten years, that it is an extremely rare occurrence to find two sharp or much worn flanges on the same axle on the first run of the wheels. Two worn flanges on the same axle have been caused by reversing the wheels in the truck after one of the wheels showed considerably flange-wear, but even this often fails to prevent the continual wear of the flange that was worn before the wheels were reversed.

"Any well-conducted wheel record that gives the defects or conditions of each wheel of a pair, will show conclusively that the wear of flanges is confined almost exclusively to one wheel of a pair. From such a record the following figures are given: During the past month forty-five wheels drawn from passenger cars have been reported 'worn flange,' and *in every case* (italics as quoted) the mate wheels are reported either worn tread or worn hollow away from the flange. As to the accuracy of these reports, it should be added that nearly all of these wheels have been twice inspected, first by the men removing the wheels, and secondly by the general inspector for the whole road. The only exception to the double inspection is for wheels that are found good enough to transfer directly to freight cars without being removed from the axles.

"The conditions shown by this months' record repeats itself, month after month and year after year, as I have had abundant means of proving.

"Without attempting to theorize in the matter, I present the above merely as a fact; and the question of shape of flanges and rails, which is now being carefully discussed, is of too much importance to be obscured by facts which apparently bear on it, but which, on further investigation, are found to be due to causes which have no bearing whatever on the question at issue."

Mr. BARR is a gentleman of high standing as a mechanical engineer, and his assertions and explanation would appear to completely neutralize the force of the inspector's statement, which is the only definite claim that two sharp-flange wheels are, in a practical sense, ever found on one axle, which your Committee have been able to ascertain. The following has further bearing on this question.

On May 29, of the same year a letter was published from Mr. J. D. HAWKS, M. Am. Soc. C. E., Chief Engineer of the Michigan Central Railroad, in which he makes the following statements:

"If it can once be settled that the shape of the rail has nothing to do with causing sharp flanges, we can then proportion our rail so as to get the greatest bearing surface for the wheels for each weight of rail. A general master car-builder of a trunk line writes me that '46 42-in. wheels, with standard tires, under the 60 ft. post office cars running between New York and Chicago, have made an average of 188,123 miles, and not a sharp flange among them. I am pretty certain that sharp flanges are the result of having one wheel on an axle softer than the other.'

"I have noticed many sharp flange wheels taken from under freight cars, where the wheel having sharp flanges shows much wear of the tread close to the flange, while the other wheel on the same axle shows a groove worn in tread at quite a distance from the flange. This certainly has a tendency to prove that in such cases the sharp flange crowds against the rail on straight lines as well as on curves, and as the wheel without the sharp flange runs on the outside rail of curves as much as the wheel with sharp flange, it seems to show that the flange is worn sharp on straight lines, and that shape of rail-head has nothing to do with causing the sharp flange.

"We have on the Michigan Central one division, the Canada Southern, remarkable for its light percentage of

curves. Mr. A. F. BULL, Master Mechanic of that division says in answer to inquiry:

"I find that in the 26 months ending March 1, 1885, we took out 69 wheels from under engines and tenders on account of sharp flanges. This is 3½ per cent. of the total wheels removed for all causes. Of these wheels, 31 were leading engine truck wheels, 10 trailing engine truck wheels, 17 leading tender truck wheels, and 11 trailing tender truck wheels. But this does not prove that there are more sharp flanges on leading axles, as we leave the trailing wheels on longer.

"That the part (if any) played by curves in causing sharp flanges is very small, is, I think, shown by the above report, as it is not disputed that the trailing wheels do not crowd against the outside rail in rounding curves."

From all the preceding, as well as from personal observation and experience, your Committee see no escape from the conclusion before announced, that, with hardly an exception, there never is but one sharp flanged wheel on one axle, the other wheel being as a rule worn away from flange. If so, it indicates unmistakably that the primary cause of flange wear is not the rail, but some cause or causes which lead the axle to run more toward one rail than the other. For, since each wheel is subjected to precisely the same rail-wear, if the form of the rail only caused the flange-wear, we should expect to find each wheel equally flange-worn. If it was partly the rail and partly some other cause, tending to make the axle run to one rail, we should expect to find both wheels somewhat flange-worn, but one wheel much more than the other. Only in the case that the form and area of the normal rail-contact had no effect to cause flange-wear, and it was wholly caused by a tendency of the axle to run to one rail, should we expect to find one wheel flange-worn and the other worn away from flange. This latter having been shown to be the case, the only possible logical conclusion therefrom is that the form of the rail has no effect whatever in itself to cause sharp flanges, apart from defects of truck or wheels to make the truck run out of true.

EFFECT OF QUALITY AND MAKE OF WHEELS ON SHARP FLANGES.

The evidence which your Committee have collected appears to indicate that the quality of the wheel has a very marked and decided influence on the proportion of sharp flanges, so much so that the proportion of sharp flanges is sometimes from four to twenty or even fifty times as great with one make of wheels as with another, the almost invariable rule being that the poorer wheels have much the larger proportion of sharp flanges. This fact also, if it be admitted to be such, clearly tends to indicate that the form of the rail has very little to do with sharp flanges. For, since both good wheels and bad wheels run over the same rails in the same kind of trucks (in the cars of any one road), the wear due to peculiarities of the rail should be distributed alike between flange and tread. Both flange and tread might be expected to wear faster in a bad wheel than in a good one, but there is no reason why the relative wear of either part should be faster in a bad wheel than a good one. On the other hand, the most difficult part of a wheel to get a good chill on is the fillet of the flange, and it is but natural that badness of a wheel should show there first.

The correctness of this reasoning is supported by experience with wheels "slid flat."

In respect to such wheels your Committee find that, so far as the evidence which they have been able to collect can show, the percentage of failures from that cause is very nearly the same with good wheels and bad wheels, although the absolute number is much greater with bad wheels. It is to be expected that any exterior cause of wear, acting exactly alike on all wheels, like sliding or the form of rail, will have the same proportionate effect.

On the contrary, the ratio of wheels removed for sharp flange to those removed for worn tread or worn out, appears from some evidence of a high character to be enormously greater with bad wheels than good wheels, and your Committee find no evidence to the contrary.

TABLE No. 6.

PERCENTAGES OF WHEELS REMOVED in 1884 for various causes of each one of twenty-four different makes, on the New York, Lake Erie & Western R. R., out of a total of 250,973 wheels and 15,595 removals; wheels by twenty-four different makers.

(Deduced from the Record of Table D, Appendix.)

CLASS 1.—SIX BEST MAKERS.—Aggregating 78.2 per cent. of all wheels in service.

MAKERS	Cracked and Broken			Shelled out	Sharp flange	Slid flat	Worn flat and worn out	Total	Percentage removals to number in service
	Broken	Cracked	Total						
1	1.2	7.2	8.4	0.3	4.8	9.6	76.9	100.	3.85
2	2.7	6.8	9.5	1.7	1.9	12.9	64.0	100.	3.69
3	0.5	14.9	15.4	0.6	1.6	25.9	56.6	100.	7.40
4	5.3	10.1	15.4	0.7	4.8	29.7	49.4	100.	0.00
5	2.0	23.2	25.2	0.6	2.6	35.0	36.6	100.	2.28
6	3.0	20.8	23.8	0.0	1.2	11.3	63.7	100.	8.97
Average	2.0	12.2	14.4	0.7	2.7	22.3	60.1	100.	4.39

CLASS 2.—SIX NEXT BEST MAKERS.—Aggregating 17.2 per cent. of wheels in service.

7	2.4	17.0	19.4	0.0	6.9	20.8	52.9	100.	8.21
8	2.5	12.2	14.7	0.1	16.1	20.4	48.7	100.	14.63
9	2.8	30.8	33.6	0.1	6.4	21.0	38.9	100.	9.26
10	1.5	27.9	29.4	0.1	2.9	18.8	48.8	100	10.88
11	1.3	9.7	11.0	0.3	23.2	33.2	32.3	100.	22.50
*12	3.1	13.8	16.9	0.0	6.1	40.1	36.9	100.	8.23
Average	2.2	23.7	25.9	0.1	8.2	21.1	44.7	100.	10.94

CLASS 3.—TWELVE WORST MAKERS.—Aggregating only 4.6 per cent. of Wheels in service.

MAKERS.	Cracked and Broken.			Shelled out.	Sharp flange.	Slid flat.	Worn flat and worn out.	Total.	Percentage removals to number in service.
	Broken.	Cracked.	Total.						
13	0.9	71.9	72.8	0.0	0.0	22.3	4.9	100.	14.40
14	3.4	59.3	62.7	0.0	0.0	23.7	13.6	100.	3.76
**15	10.4	19.6	30.0	0.3	14.2	11.9	43.6	100.	90.50
*16	0.0	0.0	0.0	0.0	54.6	45.4	0.0	100.	35.70
***17	6.3	21.9	28.2	0.0	21.8	9.4	40.6	100.	12.62
**18	4.9	14.5	19.4	0.0	24.1	17.8	38.7	100.	19.10
**19	7.9	8.6	16.5	0.0	9.3	14.3	59.0	100.	76.90
*20	1.6	22.9	24.5	0.0	4.9	15.6	55.0	100.	14.10
*21	6.0	36.2	42.2	0.0	4.6	17.4	35.3	100.	28.90
22	0.2	88.8	90.0	0.0	1.6	7.0	1.4	100.	25.20
23	5.8	26.4	32.2	0.0	3.3	49.6	14.9	100.	5.00
***24	7.5	4.5	12.0	0.0	8.9	44.7	34.4	100.	2.29
Average	4.4	37.2	41.6	0.0	12.4	20.3	25.7	100.	20.16

Bold face numbers represent makers having from 20,000 to 50,000 wheels each in service. Starred numbers indicate the smaller makers, viz: *, less than 1,000 in service; **, less than 500 in service; ***, less than 300 in service.

NOTE.—Statements covering the years 1885, 1886 and 1887 have been received since the preparation of this report and show substantially the same facts as the records of 1884.

The best evidence obtained as to this effect of quality is an elaborate statement of the wheel removals of 1884, by makers and causes, on the New York, Lake Erie & Western Railroad, given in the Appendix, and abstracted by percentages in Tables Nos. 6 and 7. This statement covers 15,595 removals from 250,973 wheels made by twenty-four different makers, which were numbered by the mechanical department in order of relative merits, according to their best judgment, without a thought of the bearing of the table, on this particular question. Because of being thus graded, and because few roads have so large a number of wheels from so many different makers, and with such careful records to abstract from, this record has particular interest. The following as a summary of the percentages deduced from the table in the Appendix, as given in Table No. 6.

TABLE 7.

SUMMARY of the percentage of wheels removed in 1884 on the New York, Lake Erie and Western Railroad for various causes.

	Six best mak's.	Six next best.	Twl've worst mak'rs	Av.of all on road.
Per cent. of whole number in service	78.2	17.2	4.6	100.0
Broken	2.0	2.2	4.4	2.4
Cracked	12.2	23.7	37.2	19.4
Broken and cracked	14.2	25.9	41.6	21.8
Shelled out	0.7	0.1	0.0	0.4
Sharp flange	2.7	8.2	12.4	5.8
Slid flat	22.3	21.1	20.3	21.7
Worn flat and worn out	60.1	44.7	25.7	50.3
Total removed	100.0	100.0	100.0	100.0

PERCENTAGE OF TOTAL NUMBER IN SERVICE REMOVED FOR EACH CAUSE.

	Six best mak'rs	Six next best.	Tw'lve worst.	Total.
Per cent. of whole number in service	78.2	17.2	4.6	100.0
Broken	0.09	0.23	0.88	0.15
Cracked	0.54	2.60	7.50	1.20
Broken and cracked	0.63	2.83	8.38	1.35
Shelled out	0.03	0.01	0.00	0.02
Sharp flange	0.12	0.89	2.50	0.30
Slid flat	0.98	2.31	4.10	1.35
Worn flat and worn out	2.63	4.90	5.18	3.13
Total removed	4.39	10.94	20.16	6.21

The ratio of sharp flanges to wheels worn flat and worn out is:

Six best makers	1 to 22.25
Six next best makers	1 to 5.45
Twelve worst makers	1 to 2.07

These makers, it should be always remembered, were not classified by numbers of sharp flanges, but according to their total characteristics, for deciding which the number of sharp flanges was only one of many details, and a very subordinate one.

This becomes apparent by comparing the single makers; No. 1 had 4.8 per cent. of sharp flanges, while No. 7 had only 1.2 per cent., the reason being that No. 1's wheels were a little softer, which gave fewer cracked and broken wheels. Not even the percentage of total removals was used as a basis of classifications, which latter, if examined, will be seen to have been on the whole very judicious, allowing more weight to safety from fracture than any single cause.

Summarizing the indications as to sharp flanges in a little different form:

Out of 1,000 wheels removed there were:

In 1,000 wheels made by the	Six best makers, 27 sharp flanges.
	Six next best makers, 82 sharp flanges (3 times as many).
	Twelve worst makers, 124 sharp flanges (4.6 times as many).

Out of 10,000 wheels in service there were removed for sharp flanges:

In 10,000 wheels made by the	Six best makers, 12 wheels.
	Six next best makers, 89 wheels (7.4 times as many).
	Twelve worst makers, 250 wheels (20.8 times as many).

This leads to the striking conclusion, to the extent that one year's removals from 251,000 wheels by twenty-four different makers can give trustworthy evidence, that the same differences of quality have nearly twice as great an effect upon the number of sharp flanges as upon the number cracked and broken, as thus:

RELATIVE INCREASE IN NUMBER OF WHEELS CRACKED AND BROKEN AND IN NUMBER OF SHARP FLANGES, CAUSED BY DIFFERENCE OF QUALITY.

	Broken only.	Cracked and broken.	Sharp flanges.
Comparison by percentages of wheels removed.			
Six best makers, standard of comparison	1.00	1.00	1.00
Six next best makers	1.10	1.80	3.04
Twelve worst makers	2.30	2.80	4.60
Comparison by percentages of wheels in service.			
Six best makers, standard of comparison	1.00	1.00	1.00
Six next best makers	2.56	4.50	7.42
Twelve worst makers	9.78	15.28	20.83

[The comparison is made by dividing each percentage of removals given in the summary below the main statement by the percentage of the six best makers standing at the head of the column].

This evidence is strengthened if taken in connection with the individual record. Thus, "No. 16" had 55 per cent. of his wheels fail for sharp flanges, the remaining 45 per cent. having all "slid flat"; the wheels, it would seem, being actually not good enough either to break, crack or wear. His immediate neighbors above and below, and likewise Nos. 8 and 11, differ from him only in degree, but do differ considerably. All their wheels were too soft. On the other hand, Nos. 10, 13, 14, 20, 21 and 22 have a very small proportion of sharp flanges (for such otherwise bad wheels), and the reason is indicated by the excessive number cracked and broken. Their badness lay in being too hard and brittle.

These conclusions are confirmed by the statistics given in the Chicago, Burlington & Quincy and other records of the Appendix, but in a less clear and decisive way, because of their narrower range. Your Committee, therefore, has not deemed it necessary to analyze them in detail, but simply refer to them. They find nothing in any of the figures which they have gathered which can be regarded as inconsistent with these conclusions.

Taking all the above figures together, and remembering that the best maker makes some bad wheels, it would almost seem as if differences of quality alone would explain all sharp flanges, without allowance either for trucks out of square, different sizes of wheels or effect of sharp rail corners. This still leaves it possible to suppose that there would be no sharp flanges even with bad wheels if the rail-corners were not sharp, except for the fact next to be considered.

TO BE CONTINUED.

A NOVEL RAILWAY APPLIANCE.—A German railway journal says that an enterprising American firm, is offering a remarkable novelty to railway travelers, viz., "squealing dolls", intended to keep the nervous and baby-haters out of a carriage. "After many years of constant labor", says the circular of this astute firm, "we have succeeded in constructing dolls which will squeal like babies. We can guarantee that no other traveler will enter a carriage with one of our A 1 dolls when wound up, and we recommend those who wish to travel in comfort and alone immediately to procure one of them. The price of one of our A 1 babies, with a loud persistent squeal, increasing in force, broken with fits of rage, is $10; that of No. 2, with a steady irritating sobbing, $5; whilst No. 3, which from time to time emits terrible screams, and can easily be stowed in the coat-pocket, is $2½." Surely such an enterprising firm deserves success.—*London Railway News.*

Electric Railways; Their Progress and Cost; Comparative Statistics.

The rapidity of the advances that electricity is making in lighting, heating, and as a motive power for all the varied uses to which it is applied at the present day, is realized by but few, outside of those immediately connected with its development.

The tendency is strikingly shown by the following brief summary of statistics relating to the growth of electric lighting, as illustrated by the figures given below;

Date, Jan. 1	No. of Arc Light Companies	Annual Increase.
1884	31	28
1885	59	47
1886	106	65
1887	171	132
1888	303	
	No. Incandescent Companies	**Annual Increase.**
1887	29	72
1888	101	
No. of arc lamps in use, Oct. 1, 1883		1,653
" " " " " " July 1, 1888		44,417
Increase		42,764

This surprising record is paralleled by that of the progress of electric railways.

One year ago the latest statistics showed a total number of 11 electric railways in operation in Europe and about 12 in the United States, which had been principally built during the two previous years, the first having been put in operation at Chicago, in February, 1883.

The mileage has increased from 50 miles in 1887 to about 89 miles, at the present time. Of these roads, the Thomson-Houston Co. is now operating 15, which were mostly obtained by the consolidation with this company of the Van Depoele roads, and they have now under construction 14 new roads, enumerated in Table A.

These 29 railways aggregate about 150 miles of track and about 300 cars, and are all operated upon the overhead wire system.

Of the four systems for operating electric railways, viz: (1) by surface conductors through the rails, or by the use of a third rail or a wire; (2) by the overhead wire; (3) by the underground conduit; (4) by storage batteries, it may be said that, with the exception of the conduit method, no road is today operated successfully by other than the overhead system. The cost and other objections to the conduit system are so serious that but 4 miles are operated upon this system, of which but one mile, at Allegheny City, is practically successful.

TABLE A.

Name of road.	Length miles.	Equipment. cars.
Revere Beach, (	1	1
Crescent,)	½	1
Lynn Highlands	1⅞	2
Bangor, Me.	5	4
Washington	2¾	3
Scranton	2	4
Syracuse	4	8
North Adams	5	6
Wichita	2	3
Des Moines	7½	8
Omaha	9	12
Danville, Va	2	4
Hudson, N. Y.	2½	3
Seattle, Wash. Ter	5	5
West End, Boston	8	20
Total	58⅛	74

Fig. 1 shows the latest generator, or dynamo for the electric railway motor current, used by the Thomson-Houston Co. It is called Generator 25, develops, as run by the steam engine, a direct current of 500 volts potential, and is about 80 horse-power.

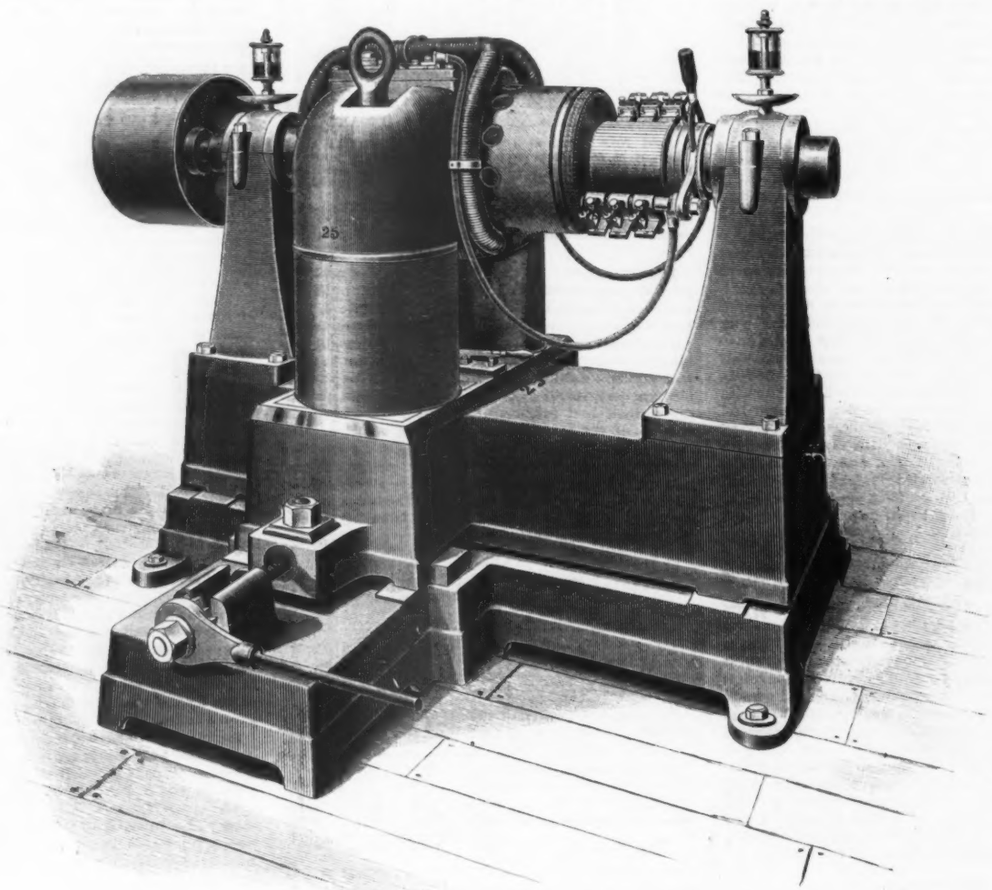


Fig. 1. 80 H. P. Dynamo for Electric Railway; by the Thomson-Houston Co.

Fig. 2 shows two motors applied to the ordinary car truck, each driving an axle, through a short series of speed-reducing gearing.

Fig. 3 is a view of the latest double truck motors, as now built. The motors fitted to cars vary in size from two 7½, or 10 H. P. each, to 15 H. P. motors. With the latter power, or 30 H. P. for the car, each car so fitted, has a surplus power sufficient to draw besides itself, two other loaded cars, in a train of three cars. The cost of equipping each carwith these motors is from $1,500 to $3,500.

Fig. 4 shows the car fitted with motors and the method of taking the current from the main wire by means of a trolley, attached to a boom, carrying flexible wires to the motors, which is dragged along the line wire after the car. The wire is of hard-drawn copper, three-tenths of an inch in diameter, and is suspended, in general, centrally over each track. Wooden, or in central city locations ornamental iron poles, are placed opposite each other in the curbs of the street, and from 100 to 125 ft. apart, and supporting cross-wires, for the line wire, are stretched across the street, at these points. The wires are not strained to more than 20 per cent of their breaking limit and the line wire is absolutely insulated from electrical connection with all supports. The return conductor or ground connection is made through the rails.

On the proposed Eckington road, at Washington, each alternate pole will be lighted by the motor current, by a cluster of incandescent lights.

In regard to danger to passengers should the full current of 400 or 500 volts potential be accidentally passed through them, it has been shown by demonstration, and with overwhelming evidence, that no danger to life can result. This point has recently been very clearly brought out by the testimony of many electricians and others before the Committee of the District of Columbia to whom was referred an order of the U. S. Senate, and which was ordered printed, Sept. 3, 1888, as Senate Report No. 2142. Arc lights, it is well known, require a potential of from 2,000 to 3,000 volts, in the line wire. The result of the investigation indicated that the danger-limit was not reached up to 1,000 or 1,200 volts, or more than double the potential found best adapted for operating electric railways, although the power of resistance varies greatly with different individuals depending upon their chemical constitution as conductors.

In regard to the relative costs of construction for street railways with different motive powers, the capital stock authorized by the charter of the Eckington & Soldier's Home Ry., Co. Washington, was respectively,

For horse power	$60,000	and for branches,	$117,000
" electric power,	102,600	" " "	219,000
" cable power,	204,000	" " "	438,000

This road comprises one mile in the city and about 2 in the suburbs, or about 3 miles total length. The underground conduit method is stated to cost about ten times that of the overhead system, or $25,000 to $30,000 per mile of single track for construction (exclusive of cost of track), while the overhead wire costs but from $1,200 to $3,000 per mile. The objections to the conduit are the leakage of electricity, which even in dry weather amounts to 10 to 15 per cent. of the power generated by the dynamo, and the difficulties relating to drainage and keeping the conductor, which is necessarily uninsulated through its entire length, free from moisture in wet weather.

The conditions of the overhead wire, electrically, are at all times preferable. The storage system is stated to cost double that of the conduit and the expenses of operating and maintenance are also about double. The system has thus far proved unreliable, and is not in practical use, except experimentally, on any railway.

The following estimates as to costs are compiled from the recent report by Capt. EUGENE GRIFFIN of the Engineer Dept. U. S. Army, to the Board of Commissioners of the District of Columbia.

In regard to the relative costs of motive power, in the first case there are required 40 horses at $150 = $6,000; in the second, the conduit, costing $20,000 in the third, the overhead wire costing $2,000; and in the fourth the conduit, costing from $30,000 to $105,000; the cable costing $13,200, extra cost for curves and driving machinery, $1,550, or a total of $40,000 average.

The comparative cost of operation is as follows:

The special expenses of operation in each of these cases are, in the first, the feeding, caring for and replacing of 40 horses at $219 per year; in the second, coal, 8½ tons per day at $2.50; engineer, $2.50, firemen at $1.50; in the third, the same items but reduced interest charge due to reduced cost of plant; and in the fourth, coal, 10½ tons per day, at $2.50; engineers and firemen as in previous cases,

Taken per car mile, the cost of operation of electric railways is from 1½ cents to 5½ cents, as compared with 10 cents, operated by horses.

The performance of electric cars as to speed, is from about the rates usually developed by horses, or 7 to 9 miles per hour, up to 15 miles per hour. The rate upon grades as heavy as 9 or 10 per cent. has been from 4 to 7 miles per hour.

The cost of construction and equipment for the storage system includes the special expense for accumulators, 880 at $12 = $1,056 per mile, and the total is estimated at $38,560 per mile. The running expenses include the cost of renewals of cells, $552, and are estimated at $8,862 per mile annually. The advantages of this method are, ease of conversion of ordinary horse railroads into electric roads; the independent action of each car, which carries its own motive power, and the avoidance of new constructions along the line of road, together with ease of extending the method on any routes where needed.

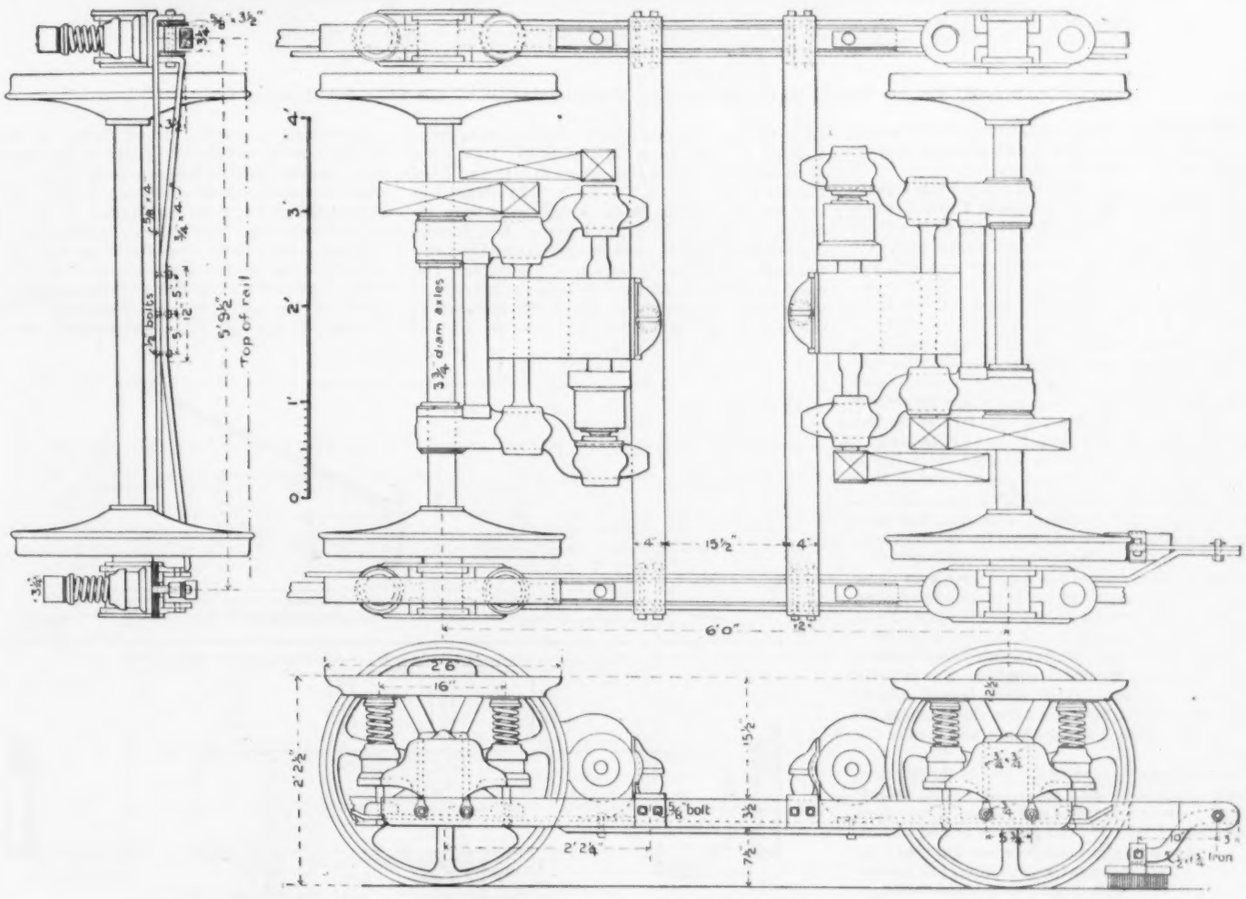


Fig. 2. Electric Motors as Applied to the Ordinary Car-Trucks; Built by the Thomson-Houston Co.

Construction and Equipment.

	Cost per mile, single track.			
	(1) Horse	(2) Electric Conduit	(3) Electric Ov'rhe'd Wire	(4) Cable
Track	$7,000	$ 7,000	$7,000	$ 7,000
Construction	4,000	2,000	6,000*	6,550
Cars, 4	3,200	2,600†	2,600†	3,600
Horses, 40	6,000			
Conduit	——	20,000	——	40,000
Steam P'wer plant	——	2,000	2,000	2,500
Dynamo	——	2,000	2,000	——
Motor trucks	——	4,800	4,800	——
Total	$20,200	$40,400	$23,400	$56,650

*Including poles and wire.
†Without the trucks.

Annual Running Expenses.
Per mile.

	Horse.	Electric conduit.	Electric overh'd wire.	Cable.
Feeding, replac'g, etc	$8,760			
Depreciation 5% and maint'n'nce	710	$1,576	$ 920	$3,900
Interest	1,212	2,424	1,380	3,400
Coal		775	775	968
Wages, engines, etc		250	250	250
Total	10,682	5,025	3,325	8,508

Taken per car, the cost of operating by the electric car, for 16 hours per day, at an average of 5 horse power, is from $1.75 to $2.50 per day, and this rate is from one-third to one-half the cost of operation by horses.

On the basis of the above estimate, the storage system costs slightly less than the conduit for construction, but the running expenses are greater than those for the cable system, but 17 per cent. less than for the horse-car road.

The efficiency of the storage system is stated to be 70 per cent. The efficiency of the electric conduit or wire method is about 80 per cent. from the engine to the car wheel. From this, 15 per cent. should be allowed for contingencies, leaving 65 per cent. of the power of the engine to be relied on for actually moving the cars.

This is a very good showing and one that indicates that the electric railway is already upon a practical commercial or paying basis. The development, after horses have been superseded, will probably be in the direction of still greater economy, by the running of the cars in trains of three or more, by the gradual use of larger amounts of power, and the lengthening or increasing of the capacity of the car.

A 335 ft. Chimney.

The tallest chimney in America, and fourth in height in the world, has lately been erected at the works of the Clark Thread Co., at Kearny, near Newark, N. J. The shaft is circular and 335 ft. in height; it is 28 ft. 6 ins. in diameter at the base and 14 ft. at the neck. Its internal diameter is 11 ft. in one circular flue. The top is surmounted by a cast-iron coping weighing 6 tons and made in 32 sections bolted together by inside flanges.

The foundation is concrete, made with 6 parts crushed limestone, 3 parts sand and 1 part German Portland cement. This foundation is 40 ft. square and 5 ft. deep, resting on a bed of firm gravel. On this is founded the base of the chimney of brick and extending 4 ft. above the surface of the ground. The material used was brick laid in mortar made 1½ sand to 1 of Portland cement. The shaft up to 160 ft. in height was laid with mortar made of 6 parts sand, 2 parts lime and 1 part cement; the sand and lime have stood for 3 months previously made up as mortar, and the cement was added just before use. The top of the chimney was laid in mortar made of 3 parts sand to 1 of lime and 1 of cement.

The outer bricks were first quality North River, and the backing bricks were of a good quality, New Jersey brick. At intervals of 20 ft. an iron ring 4 ins. wide, ¾ to ½ in. thick placed edgewise, was built into the walls about 8 ins. from the external surface.

At the base the chimney is double, with an outer wall 5 ft. 2 ins. thick, and inside of this is a second 20 in. wall placed about 20 in. inside the first. From the interior of the main wall 8 buttresses are built up, nearly touching the main flue wall and intended to keep the flue proper from sagging. The interior wall starting with 20 ins. in thickness is gradually reduced until at 90 ft. high it is 8 ins. thick, and at 165 ft. it ceases entirely. No fire-brick was used in the lining.

Two horizontal flues enter the base of the chimney directly opposite to each other, and a 12-in. deflecting wall is built across the shaft between these flues for a height of 16 ft. The two flues are arched and are 7 ft. wide and 8 ft. high, and in these flues will be placed feed-water heaters for the boilers; 21 boilers of 200 H. P. each will depend on this one chimney.

The lifting work was done by an inside elevator, with a 3½ × 3 ft platform, running between 4 × 6 in. guides braced against the inside walls. The interior platforms, erected at every few feet, rested upon two 3×8 in. beams built in the walk. The greater part of the brick laying was done by 8 bricklayers and 5 helpers, with 7 laborers on the ground supplying material.

The foundation and base were put in and the shaft run up 18 ft. in December, 1887. The work was again commenced in April, 1888, and finished in September, or in 150 days of 9 hours each. The total weight is about 5,000 tons, divided as follows: Brickwork, 9,051,900 lbs.; concrete, 1,000,000 lbs.; iron-work, 40,000 lbs. The base contains 1,600 sq. ft., which would give a load of about 2.8 tons per sq. ft. No permanent means of access to the top were provided; as if such access becomes necessary a small balloon can be sent up the shaft with a line and allowed to descend on the outside, and a line sufficiently heavy for use is thus carried up.

The highest chimney in the world is the Townsend chimney in Glasgow, 454 ft. The second is the Tennant & Co. chimney, in the same city, 435½ ft., and the third is the Dobson & Barlow chimney, Bolton, England, 367½ ft. This Clark chimney is the fourth in order of height.

Water Supply of London.

Spring water was formerly conveyed to public reservoirs in the city of London by leaden pipes from various springs in the vicinity, viz., from Tyburn in 1236, from Highgate in 1438, from Hackney in 1535, from Hampstead in 1543, and from Hoxton in 1546. SIR J. RENNIE says in his treatise that for these useful works the citizens were indebted to the munificence of several lord mayors and other individuals, but those of Hampstead and Highgate are the only ones now remaining. The open watercourse or conduit from Dartmoor, 24 miles long, for supplying Plymouth with water, commenced by Sir FRANCIS DRAKE in the reign of ELIZABETH, and the New River for the supply of London, 39 miles long, 28 ft. wide, and 4 ft. deep, falling 3 ins. in a mile, by Sir HUGH MYDDLETON, in 1613, are considerable works of the kind, and were planned and executed at the cost of those distinguished individuals. MYDDLETON was, in fact, ruined by it, and adopted the profession of engineer and surveyor to obtain a livelihood. London Bridge water-works were commenced by MORRYS in 1582, with water-wheels turned by the flood and ebb current of the Thames, passing through the purposely contracted arches of Old London Bridge, and working pumps for the supply of water to the metropolis; it was the earliest example of public water service by pumps and mechanical power which enabled water to be distributed in pipes to dwelling-houses. Previously water had only been supplied to public cisterns, from whence it was conveyed, at great expense and inconvenience, in buckets and watercarts.

In addition to the London Bridge and New River, several minor establishments of the same kind were afterwards erected on the banks of the Thames, to supply separate districts in their immediate vicinity. Some were worked by water-wheels on the sewers which discharged themselves into the Thames; others, by horses; and one by a windmill. That at Broken Wharf in 1594, at Shadwell and York Buildings, worked by horses, and at Chelsea by water-wheels, may be mentioned. Early in last century, when the old cisterns had nearly disappeared, and water was supplied to the dwellings, a great improvement took place by the application of the steam engine (which had then begun to develop its extraordinary powers) to the York Buildings water-works by SAVERY, in 1710, and afterwards by NEWCOMEN in 1730. NEWCOMEN'S engines were subsequently applied at Chelsea, Shadwell, Stratford, London Bridge, and the New River water-works. As soon as WATT had brought his improvements into operation for pumping water, his engines were applied at each of the above water-works by degrees, in addition to the old engines.

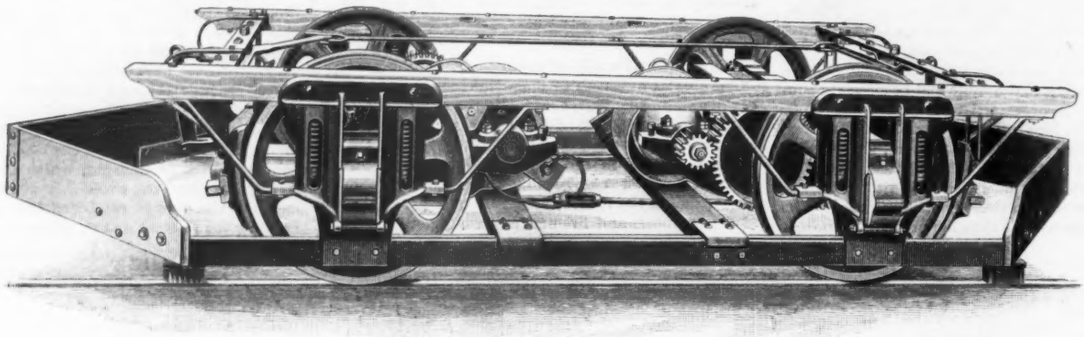


Fig. 3. Double Truck Motor for Electric Railway; Built by the Thomson-Houston Co.

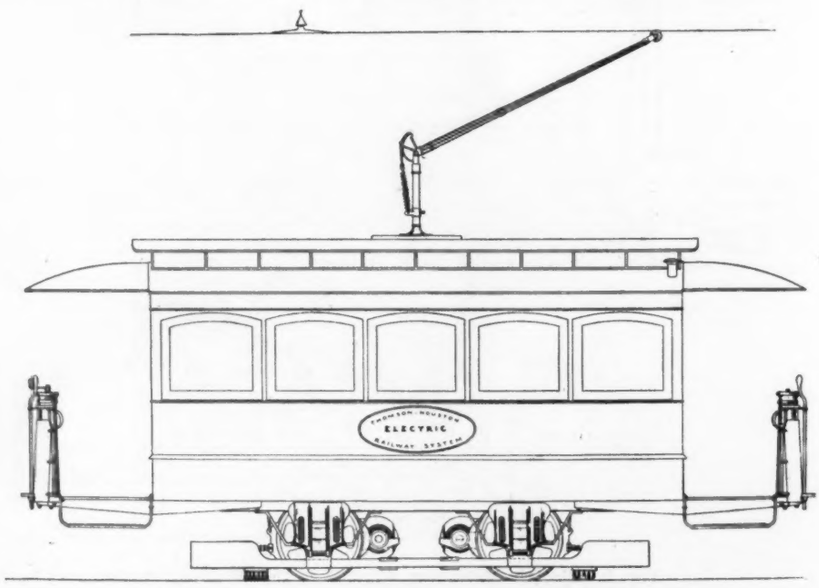
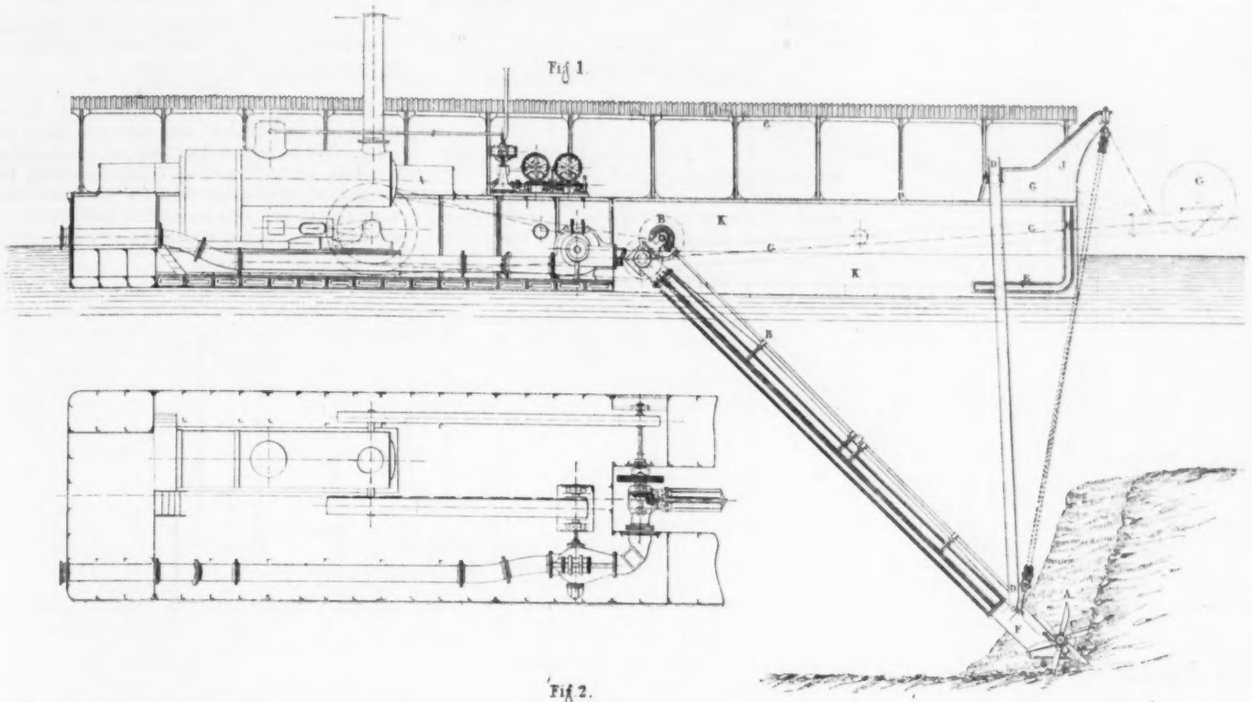


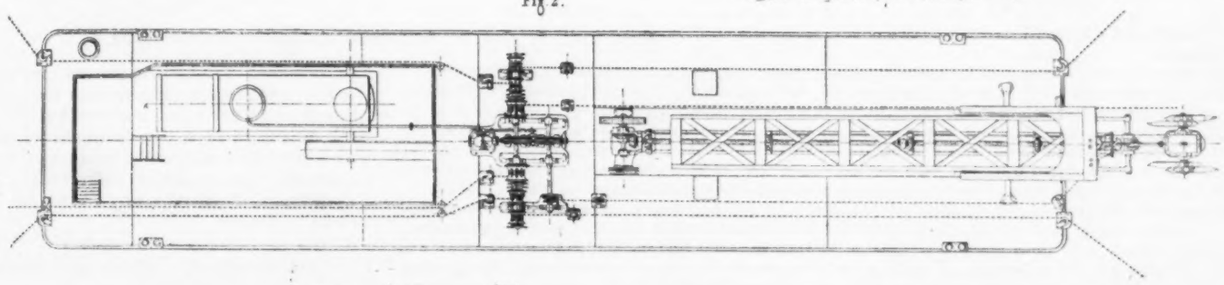
Fig. 4. Car Fitted with Motor, and Overhead Wire.

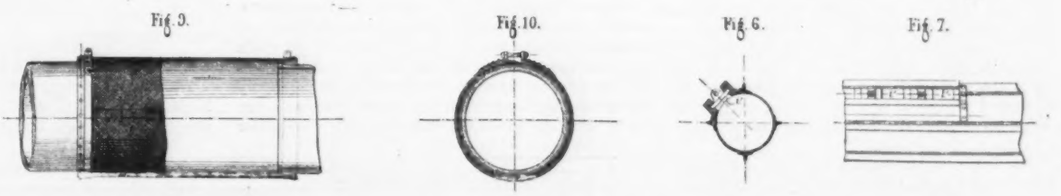
ABOUT a year or more ago Chicago apprppriated $10,000 for the erection of a garbage cremating plant as an experiment, to dispose of, from May 1 to Nov. 1, about 1,000 tons of garbage. The plant adopted is the MANN patent. The furnace has been in operation since last April, and it cost complete about $11,000. The capacity is 150 tons per day, though it has never been pushed to its utmost, owing to the expense of cartage. During June the furnace consumed 103 tons daily for 26 working days at a cost of 25¼ cts. per ton for labor and coal, exclusive of the cost of delivering the garbage. With 150 tons daily this cost could probably be reduced to about 17 cts. per ton.

A French Suction Dredge.

The suction dredge here illustrated and described is used at Panama and for the removal of the island of Cazeau, Gironde, France. It was built by HENRI SATRE, of Lyons, France, upon the plans of VERNANDON Bros., and was patented about one year ago.







French Suction Dredge; M. M. VERNANDON, *Engineers.*

Figs. 1, 2: Plan and sectional elevation. Figs. 9, 10, Joints to floating discharge pipe. Figs. 6, 7; Sliding valve at foot of suction pipe.

The description is taken from *Le Genie Civil* of Oct. 20. It is essentially a suction dredge in which the material is first loosened by revolving cutters, then lifted by a centrifugal pump, and finally discharged upon the land at a distance of 1,600 ft. or into tank boats alongside. It is reported as having given excellent results in the work at Cazeau, working in tight clay, in sand and in muddy sand.

The boat itself is 80 ft. long, by 24.6 ft. wide by 8.25 ft. draft, and the limiting depth of the dredging operation is 33 ft. The dredge-pipe has a diameter of 1.13 ft. and it is suspended in a well 36 ft. long, on the axis of the dredging boat. The dredge pipe is connected by a vertical joint with the pump and the outlet pipe is carried to the rear of the boat as shown in Fig. 1. Just at the junction of the dredge pump and the pipe is a door by means of which a workman, without stopping the pump, can rapidly extract any excessively large lumps, stone or other matter that might otherwise damage the blades of the pump. At the lower end of the suction pipe is a box *O* carrying the cutters the necessary stiffness in working, a metal stiffening frame, *D*, Figs. 1 and 3, is connected with the end of the tube and passes through a hinged guide *E*, braced between the sides of the well *K K*. When the dredge is not at work, the suction tube and brace can be lifted above the surface entirely, to the position *G*, Fig. 1.

The guiding of the pipe by the aid of the screw constitutes an important improvement on the ordinary suction dredging apparatus where the pipe is moved laterally by the helm, an arrangement which does not assure the same degree of stability during the work and increases the difficulty of steering. To regulate at will the admission of water into the pipe, this pipe is provided at the sides with adjustable valves (*i*, Figs. 6, 7.) made up of three slides placed over rectangular orifices. These slides are worked by hand by means of a shaft parallel to the axis of the pipe which operates, by a worm, a pinion fixed to the slides. Besides the permanent advantage of regulating the admission of water to the pipe, these valves are of especial use in case the cutters are buried under a caving-in of the material; they then enable the operator to draw in clear water and drive away any material that may be clogging the pump, and when shut and the pump is stopped, the dead weight of the water column acts to disengage the cutters.

The disintegrating apparatus must be modified to suit the material operated upon, and upon this adjustment, in fact, depends the capacity and success of the dredge. In argillaceous sand and in tight clay Messrs VERNANDON use a shaft armed with a double set of cutters as shown in Figs. 4, 5. These cutters, solidly keyed and bolted in their sockets, present helicoidal forms reversed in action with each other, and so arranged as to throw in towards the mouth of the pipe the material cut loose. When working in a compact soil, where there is no danger of caving, the cutters are placed at the extreme end of the suction tube; and in muddy sand, it is convenient to place the cutters some distance back of the orifice to the pipe.

M. VERNANDON has recently patented a cutter intended for use in compact material, like clay. This is shown in Fig. 8, and has its blades arranged in a cone with the blades *a'* bolted to arms *b'*. Each of the cutter-blades is provided with other blades *c'* placed at right angles to the axis of the shaft, which

operate by cutting the material into slices while the main blades cut it in the other direction and, by reason of their arrangement as a cone, feed it into the mouth of the tube. The knives *d'* fixed in front of the system of cutters serve to advance or disengage the apparatus. The whole system of blades is

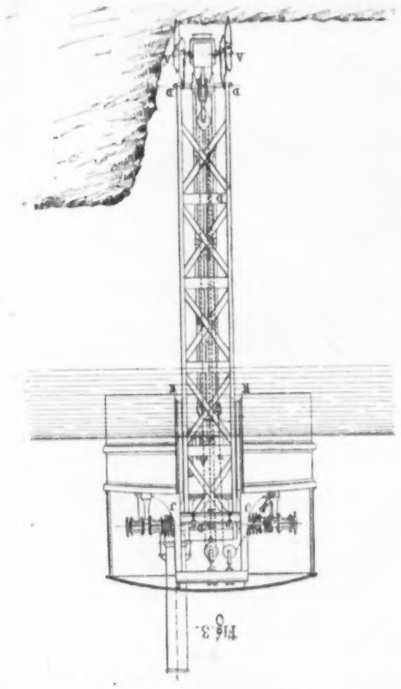


Fig. 3. Cross-Section Showing Brace-Frame to Suction-Pipe.

tied together and solid work assured by two circular bands *f'*.

Figs. 4 and 5 show the gear used for operating the cutters, and the main shaft is worked by another gear at the upper end, shown in Figs 1 and 2. In the original machine a sprocket wheel and chain belt was used ; but as this was inconvenient in a necessary change of angle of the dredging tube and liable to breakage, it was soon abandoned for the bevel-gear now used. The lubrication of the shaft bearing is provided for in the sleeve *h'*, Fig. 8, which is filled with tallow.

The centrifugal pump to be used in sucking up the material is placed below the water-line of the dredging boat. The result of this arrangement is that the necessary force for sucking up the material practically depends only upon the difference in density of the surrounding water and a column of water charged with sand or clay, and the dredge can thus work at variable depths without a sensible increase in the motive power.

The dredged material passes through the pump and is discharged at once by means of floating tubes. These tubes are made of sheet iron, after the patents of Messrs. VERNANDON, D'ESPINE and ACHARD (see Figs. 9, 10). The joints between the sections are made supple by connecting these sections by a short sleeve made of wire net-work, the wires woven diagonally or spirally and crossing each other, and outside of this net is a tight rubber or leather sleeve. The machine operating the pump and the cutter shaft is a compound engine with the following dimensions :—Diameter of small cylinder, $12\frac{5}{8}$ in.; large cylinder, 22 in.; stroke, $11\frac{1}{2}$ in. This machine developes 120 H. P. indicated, with 190 revolutions per minute.

With this dredge the Messrs. VERNANDON have excavated and transported a distance of 1600 to 1800 ft., with a mean lift of 16.4 ft., the following quantities in a month of 25 days, with 10 hours work each day :—In digging in tight clay 13,000 to 14,800 cu. yds. ; in sand and mud, 36,400 to 40,000 cu. yds. The proportion of material raised to the water lifted with it is on the average 10 to 12 per cent. for clay, and 30 per cent. for sand and mud. In working in sand this proportion sometimes touches 40 per cent. The material has also been delivered at a point 32 ft. above the water level. A gang of 4 men work the entire machine ; one at the engine, two at the hoists and one at the pipe ; with these is usually a *mousse* or cabin-boy.

One of the interesting features about this dredge to American readers is that, as near as can be learned, the same principle practically, though on a more extensive scale, is being now tested on the Gedney Channel bar at the mouth of New York harbor.

CORRESPONDENCE.

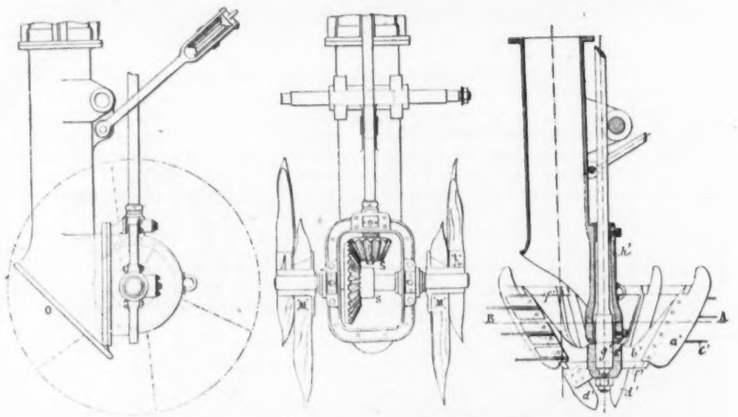
A Train Split on a Switch.

PROVIDENCE, R. I., Nov. 4, 1888.

EDITOR ENGINEERING NEWS :—

The following account of a strange accident on the Stonington R.R. on the morning of Nov. 2, with the enclosed sketch of the scene of the accident

Fig 4. Fig 5. Fig 8.

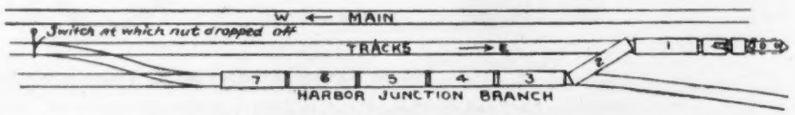


Figs. 4, 5, 8. Cutting Apparatus at Foot of Suction-Pipe.

(drawn from a plan furnished by the N. Y. Prov. & Boston Co. but, as you will observe, done without instruments and not drawn to scale) may be of interest. The company is now putting in interlocking signals to control the diverging traffic at Auburn Junction, of which improvement I hope soon to be able to send you an account.

The accident was a peculiar and extraordinary one, the only one of the kind that the Stonington Line has ever experienced, and happened Nov. 2 to the second steamboat train when running through Auburn. Happily there was no serious result, though there might have been if the engineer had not been on the alert. About 6:55 A. M. the train was moving at 40 miles an hour. Auburn was passed without trouble, but between the highway bridge and the Roger Williams Park station, a nut

pped off the rod of the switch leading to Harbor



A Train Split on a Switch.

Junction at the point shown in the sketch. The engine and one car had passed the switch before the loss of the nut had any effect. The first truck of the second car also passed the switch. The second truck of the second car ran upon the Harbor Junction track and the other cars followed. Thus part of the train was on one track, part on the other, and one car, connecting the two parts, stood across the space between the tracks. Fortunately, the engineer was alert, and at the very instant that the last named car ran upon the switch, he felt the irregular movement of the train behind him, and applied the brakes, bringing it to a standstill in the position shown. The wrecking train and engine are kept at Auburn, and were at work within twenty minutes from the time the accident occurred.

The Harbor Junction branch is used chiefly for coal traffic from the water front, only two passenger trains a day being run over it, the main line at this point is laid with 76 lb. steel rail with 24 in. angle bar joints ; the branch line is probably of lighter metal. The numbers are not those borne by the cars but simply their order in the train. The quick stop was particularly timely, as a short distance ahead both tracks diverge, the two main line tracks swinging off to the left around the shortest curve on the main line and the Harbor Junction track curving off to the right.

I send this in the belief that you may be interested in what appears to be a novel accident in which no damage of consequence was done.

Yours truly, C. E.

[The accident is an interesting one, but by no means so novel as our correspondent implies. We have noted several of them within the last year, including some in which the cause of the train splitting on the switch was not so clear as in this case. It is bad practice to use nuts on switches which can by any possibility get loose. The train appears to have been stopped by the air brakes in less than 400 ft. from 40 miles per hour, which is pretty good work, although in a test it would be pretty slow work. The accident is another of the innumerable cases in which train brakes have almost certainly saved many lives. ED. ENG. NEWS.]

The Chilian Railways Which Americans are to Build.

SANTIAGO, CHILI, August 18, 1888.

EDITOR ENGINEERING NEWS :

Yesterday two very interesting numbers of ENGINEERING NEWS, (June 2, and 16,) reached me, in due course of mail, and reminded me that in my letter from Panama I promised to write you again. You probably know the object of my mission to this section of the world ; but a brief statement of that object and its results, to date, may not be without interest to yourselves and your readers.

The Chilian Government, by public advertisement, called for bids for the construction of a system of national railroads ;—these bids to be opened on the 30th, of last month. The commission, of which I am a member, to look into this matter on behalf of well known New York capitalists and contractors arrived at Santiago, on the 5th day of July. We found already upon the field of operations two rivals from Europe, and one local *entrepreneur*. Our European competitors were, *La Société de Construction de Batignolles*, of Belgium, and *La Compagnie Commercial Francaise*, each represented by an engineer. The local *entrepreneur* is an American who has been in Chili for some years trying to "catch on"

in various schemes. He claims to be backed by a large and responsible contracting firm of the United States. Whether this is so or not is a case of "*quien sabe.*" A week or so after us came a couple of live, active young men from Canada representing only themselves and their own energy and pluck and the savings of several years' hard work in British Columbia and California in railroading.

When the 30th of July came there were only two formal propositions handed in to the Ministry of Public Works.

These were made by the Belgian and French companies. Our party declined to make a proposition on the ground that the data with which we had been furnished and our time in the country had both been inadequate to enable us to make an intelligent and safe bid. Our Canadian cousins took the same ground; our ex-American *entrepreneur* had reasons of his own for not submitting proposals.

The result therefore was that on the 30th of July the Ministry of Public Works opened two bids only, after having advertised for months in all the civilized countries of the world that the Government desired to contract for railroad work and material valued at about three and one-half million pounds sterling. The railway lines advertised and the sums fixed by the Chilian Government as maximum costs are as follows:

1. From Victoria to Valdivia and Osoma, 403 kilometres long 5 ft. 6 in. gauge, not to exceed £1,685,000.
2. From Coilme to Mulchen, 43 kilometers, 5 ft. 6 in. gauge, £112,000.
3. From Tomè to Cauquenes and Porral, 200 kilometres, 1 metre gauge, £350,000.
4. From Talca to Constitucion, 85 kilometres, 1 metre gauge, £270,000.
5. From Palmilla to Alcones, 45 kilometres, 5 ft. 6 in. gauge, £100,000.
6. From Pelequen to Peumo, 28 kilometres, 5 ft. 6 in. gauge, £90,000.
7. From Santiago to Melpilla, 59 kilometres, 5 ft. 6 in. gauge, £200,000.
8. From Caliva to La Sigua and Cabildo, 76 kilometres, 1 metre gauge, to cost £350,000.
9. From Los Vilos to Salamanca and Illapel, 128 kilometres, 1 metre gauge, £220,000.
10. From Huasco to Vallenar, 48 kilometres, 1 metre gauge, £65,000.
11. From Ovalle to San Mancos, 60 kilometres, 1 metre gauge, £150,000.

With these roads the following equipment is called for: 33 broad gauge locomotives; 25 narrow gauge locomotives; 52 1st, 2d and 3rd class, broad gauge passenger coaches; 34 1st, 2d and 3rd class, narrow gauge passenger coaches; 343 broad gauge baggage, box, express and platform, etc., cars; 220 narrow gauge, baggage, box, express, platform, etc., cars; 78 hand cars of different types. A complete outfit of telegraphic appliances, stations, roundhouses, turntables, workshops, warehouses, water tanks, signal stations, switches, semaphores, etc., are included in the plans, specifications and estimates.

The result of the first effort at securing contracts was a complete failure, which was officially announced in a decree on the 3rd of August.

The substance of that decree was as follows:

Having opened the proposals of *La Société de Construction de Batignolles* for the construction of the railway from Santiago to Melpilla, from La Caliva to La Sigua and Cabildo, from Los Vilos to Salamanca and Illapel, from Ovalle to San Mancos, and from Huasco, to Vallenar, and finding that said proposals exceed the limit set by the Government by the sum of £747,000 and finding also that the proposals of the *Compagnie Commercial Francaise* to construct the railways from Santiago to Melpilla, from Palmilla to Alcones and from Pelequen to Peumo, exceed the limit set by the Government by the sum £125,000. * * Therefore, both of these proposals are rejected.

These two companies submitted proposals on only the shortest and easiest lines, projected by the Government.

The bid of the first was just 84 per cent. above the Government's estimates; that of the second was 32 per cent. above the estimates; and the two together did not include one half of the entire system of proposed roads; and neither of them touched the great Southern route down the Central Valley of Chili from Victoria to Valdivia and Osorno.

This failure to secure acceptable propositions was evidently quite a disappointment to the Chilian Government. It has resulted in our being able to enter into direct negotiations with the Government, which negotiations have been in progress for the past two weeks, and at this present writing, it seems very probable that an arrangement will be perfected by which the whole business will fall into the hands of the company we represent, on very favorable and satisfactory terms.

Yours Truly,

S.H. LOCKETT.

[The above interesting letter of Col. LOCKETT gives fuller details than elsewhere published of the great Chilian railway contract which was finally secured last week by the American syndicate represented by the firm of COMEGYS & LEWIS and by the Union Bridge Co., both of New York City. The price agreed upon was in excess of the $35,000,000 appropriated by the Chilian Congress for this work, and as a consequence the contract had to be again submitted to that body. On Oct. 19, the Senate agreed upon the new terms, and last week a cablegram announced its ratification by both Houses and by the President.—ED. ENG. NEWS.]

Nomination of Officers in the Am. Soc. C. E.

New York, Nov. 1, 1888.

EDITOR ENGINEERING NEWS:

Your remarks in your issue of Oct. 27, upon the method of nominating officers for the American Society of Civil Engineers are very apropos.

In my opinion our present clumsy method of making such nominations needs revision; while it has answered fairly well for the past, occasionally we have results that can hardly be considered satisfactory. All must realize that the early and older pioneers of our still young Society have nearly all been honored, and we are approaching the condition when marked and universally recognized candidates for our highest honors are becoming rare, although we could name at least a score or two who could be considered as eligible candidates for the position of our president and vice-president from their professional experience and reputation alone.

This condition makes our present method of nomination a difficult and unpleasant labor. To leave the selection of our officers to five members taken somewhat at random from widely separated districts has other very grave defects.

The management of the Society affairs must necessarily be a local one. Our Society is an incorporated body holding trust funds and other valuable property. Our Board of Directors under the State laws are trustees of such property and are personally liable for their manner of administrating the same. The law requires that all action by such board of trustees should be performed by a quorum of such board.

To ensure such a quorum, it is necessary that more than a quorum should be resident within reasonable limits of the city of New York, for even every resident member of such a board cannot always be present at the frequent meetings necessary.

One member of such a board, who is either negligent or indifferent as to his duty, can hamper the business of the Society or make doubly onerous the labors of the remainder. Now I believe the general membership little appreciate the duties performed by our board. Having been a Director for two years, and being generally cognizant of the action of our board for several years past, I can freely say that it is a thankless and onerous position. That working professional men, whose days give them a full share of work and worry, should meet on an average of one night in every fortnight and devote from three to four hours to considering the merits of candidates, the management and investment of our receipts and trust funds, to make appropriations, to hear complaints and various matters that are constantly presented for the action and decision of the board, is not a duty that many of our members desire to assume of their own free will.

When the list of resident members, who would be willing through their interest in the progress of our Society to undertake the duties of a director, is taken up and those eliminated who live in the suburban districts, or who from family or personal reasons could not devote their evenings to such duties, the remaining eligible list would not be a large one. That in the past the management has been thus confined to a limited number of members has given grounds for the belief that the Society has been run by a local few and injustice has been done this local few, in my opinion, from a want of comprehension by the general membership of the reason therefor.

One year's membership on the board is almost necessary before a new member is fully fitted for his best usefulness. Some of our best men have been dropped after one year's service. This is not only unjust as failing to appreciate faithful service, but is against the best interests of the Society. The membership of our board is spoken of as one of honor. How an honor? Let any member who reads this, try and name the present Board of Direction without looking at his catalogue, I doubt if 5 per cent. of our membership could name one-half of the present board off-hand. You mention the President and Vice President as tending to become "ornamental." They have not been in the past simply ornamental. Mr. WELCH, living in Lambertville, N. J., and Mr. GRAFF, living in Philadelphia, seldom missed a board meeting, and never when specially important business was to be considered. Mr. WHITTEMORE, of Milwaukee, and Mr. KEEFER, of Ottawa, Can., attended several meetings during their terms of office.

Among the directors during the past year, Messrs COHEN, of Baltimore, and WILSON, of Philadelphia, were very regular attendants, though at much personal inconvenience. I do not mention these as isolated and exceptional cases, but as coming within my own cognizance and memory.

Now, for the working force of our board, how can five members composing the nominating committee make an intelligent selection? Sometimes none, and seldom more than one of them know anything of the necessities of the case, or of those who do deserve further honor for the duties they have already performed. They can only get such information through those local members who have such knowledge, but they are sometimes disabled from using such means by their preconceived prejudices that such local members have had too much influence during the past. The result is hap-hazard and frequently improper nominations by substituting new and lukewarm members for those who have been earnest and thorough.

Another grave trouble with our nominating committees is their failure to properly feel the membership as to the position of highest honor. A clique of a dozen members, by numerous letters to each member of the nominating committee can produce an effect of a popular demand for their candidate. A nomination thus obtained would not be so harmful if such a clique put forward a candidate as the representative of some principle, for such could be contested upon that basis. Should it be based, however, solely upon personal interest in the candidate or local pride, the honor and dignity of our Society would suffer very much. What other plan could be adopted, which would better serve the purpose, I am not prepared at present to suggest, but I hope that sufficient interest by discussion may be raised to have the matter properly taken up at our meetings in the near future.

I do think an essential feature of such a plan should be the formation of two tickets, bringing forth an honorable contest for the honors. It not only would be a good healthy stimulant for such honors, but would be more of an honor to the successful candidate than now, as being the selection of a majority of the members rather than solely the accidental selection of five men.

The working members, at least, of our Board should be elected for two or three years' and so arranged that sufficient of the more experienced mass be left to leaven the new material.

THEODORE COOPER.

[We agree fully with our correspondent that some change of system is needed, but leave it for others to discuss what it should be, if they are so disposed.—ED. ENG. NEWS.]

ENGINEERING NEWS
AND AMERICAN RAILWAY JOURNAL

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D. McN. STAUFFER, A. M. WELLINGTON.
EDITORS.
GEO. H. FROST. - - - - - BUSINESS MANAGER.

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

Civil Engineers' Club of Cleveland, O.—Regular meeting, Nov. 13. Report on Mechanical Engineering. Secy., James Ritchie, Case Library Rooms.

National Association of Brick Manufacturers.—Annual meeting at Memphis, Tenn., Nov. 13, 14, 15.

New England Railroad Club.—Next meeting at Boston & Albany R. R. passenger station, Boston, Mass. Nov. 14.

Engineers' Club, Philadelphia, Pa.—Regular meeting, Nov. 17. Secy., Howard Murphy, 1123 Girard St.

Engineers' Club of Kansas City, Mo.—Regular meeting, Nov. 19. "Present Status of the Electric Railway Problem", Dr. Wellington Adams; "Shrinkage of Material and Settlement of Embankment." Secy., Kenneth Allen, Y.M.C.A. Building.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, Nov. 20. Secy., S. M. Wickersham, Penn Building.

Boston Society of Civil Engineers, Boston, Mass.—Regular meeting, Nov. 21. Secy., S. E. Tinkham, City Hall.

American Society of Civil Engineers, New York.—Regular meeting, Nov. 21. Secy., John Bogart, 127 E. 23d St.

New York Railroad Club.—Next meeting, Nov. 15, at 113 Liberty St., New York City. "Freight Train Brakes."

Civil Engineers' Society of St. Paul, Minn.—Regular meeting, Dec. 3 Secy., Geo. L. Wilson, City Hall.

Western Society of Engineers, Chicago, Ill.—Regular meeting, Dec. 5. Secy., L. E. Cooley, 171 La Salle St.

THE preliminary report of the Committee of the American Society of Civil Engineers on "The Proper Relation to Each Other of the Form of Rails and Wheels", the second installment of which we give this week, leaving a short portion only to complete it, is one which, it may reasonably be hoped, will do much to settle practice in regard to the form of rails, and cause a reversion of the unfortunate error which was made two years ago by the Master Car Builders' Association in adopting a smaller fillet radius, for the interior corner of the flanges of wheels, than had heretofore been customary; since the report gives for the first time in the history of action and discussion of this question, a large body of definite statistics and experimental facts. There has been a plentiful lack of even an effort to collect such records in the past, and hence the recent novel theory that rail and wheel should fit each other all around the corner of the flange has obtained a currency which it never could have done otherwise. If the uniform indications of the large body of facts which have been collected by the Committee are to be trusted, quite apart from their reasoning based thereon, this is precisely what should not be done—the very thing of all others to be avoided; and we may add that in reaching this conclusion, as the Committee appear to have done, although they have carefully avoided expressing any conclusions until the preliminary report has had full consideration and discussion, they are only reverting to the conclusions reached in 1874, by no less careful an authority than ASHBEL WELCH, and repeated in 1882 by so careful a student as Baron VON WEBER. The contrary movement was started in 1883-4, and chiefly by Mr. M. N. FORNEY and ROBERT H. SAYRE, both gentlemen who deservedly carried great weight, but who are now shown to have been misled in part by erroneous statistics. Their initiative led the Pennsylvania and several other roads to adopt a round cornered rail, and the M. C. B. Association to adopt a sharp cornered flange, but the action as to rails has already been largely reconsidered, and the action as to wheels probably will be in time, since the new form has certain manufacturing disadvantages as well as less durability and safety.

WE cannot attempt in this issue to discuss the report in detail, nor perhaps shall we for some time; but every man having to do with rails and wheels should read the report itself, and we may add that if any wish to do so who are not members of the Society and have not already been sent copies, we shall be pleased to see that a copy is sent them. The newest and most striking fact brought out by the report is perhaps that flange-cut wheels have absolutely the longest life of any; an even longer life than that select class which "die of old age," *i. e.* by gradual and even abrasion of the tread without developing any sign of organic defect. It follows that efforts to cure flange-cutting have something like the same absurdity as would an alarm about some disease among human beings which was carrying off its victims at the early age of 90 or 100. The next most significant fact, perhaps even the most significant, is the all but absolute evidence from records of rail wear that sharp cornered rails wear longest, and that their rate of wear increases in direct proportion as their corner is worn away "to fit the flange", as must necessarily be the case in time on the outside rail of curves, whatever the original form, but it appears is never the case elsewhere, the rails wearing to a sharp corner even if originally round-cornered. Although it would be difficult or impossible to get any corresponding direct evidence as to the laws of wheel wear, it is a fair presumption that whatever wears the rails most wears the wheels most, and hence that the rail and wheel radii should be made as dissimilar as it is practically proper to make them.

With this brief note we leave the subject for the present, adding only that the Committee will be glad to receive discussions from any one interested who has any facts, or theories based on facts to contribute, which may be sent either to Mr. H. STANLEY GOODWIN, Chairman, Supt. L. & R. R., Bethlehem, Pa., or to the editor of this journal

THE list of members of the Canadian Society of Civil Engineers, just received, shows a large growth, indicating that the society "filled a void". Its membership is now:

Members	256
Associate Members	87
Associates	41
Students	142
	526

Since the date of the catalogue (which is marked simply "1888") further additions have brought the society up to a total of 550, or considerably over half as many as the American Society of Civil Engineers contains. The total population of Canada is now about 4,800,000 and of the United States, 63,000,000, or 13.1 to 1, The United States being much richer per head, the total number of engineers is nearer to 20 to 1; but even at 13 to 1, a proportionately numerous American Society of Civil Engineers should contain 6,150 members, or several hundred more than the membership of the Institution of Civil Engineers. No doubt a large proportion of the full members of the Canadian society are men who could not and ought not to be admitted as full members in a society like the American Society or Institution, maintaining a high standard of membership; but the proportion in the junior grades is much larger in the Canadian than in our society, and if the latter had, besides its present membership of about 1000, the 5,150 others in its junior grades who should be in it in some grade to make it as representative of the whole profession as is the Canadian Society, we may be quite sure that its influence and usefulness would be vastly greater than it now is.

WE are gratified to learn that Hon. WM. JARVIS MCALPINE and Gen. GEO. SEARS GREENE were elected Honorary Members of the American Society of Civil Engineers at the same time as Col. JULIUS W. ADAMS, anticipating our suggestion of last week. By some accident, a notification which was mailed us Oct. 26 failed to reach us.

THE 37th annual report of the Allegheny Valley Railroad contains the following remarkable table,—remarkable, that is, as an evidence of progress, but by no means remarkable as compared with what has been done elsewhere, since it is merely a chance example of a universal tendency—which we commend to the attention of our English friends who have been having such a long drawn out controversy (entirely confined to their side of the water) as to the comparative merits of "English and American Locomotives."

Average Number of Loaded Cars hauled by Freight Engines per mile run, on River and Low Grade Divisions, Allegheny Valley Railroad:

YEAR.	River Division	Low Grade Division	Rec'ts. per ton per mile cts.
1876	20.1	18.9	1.96
1877	20.9	20.4	1.71
1878	20.6	19.3	1.60
1879	21.3	21.6	1.37
1880	21.4	21.3	1.32
1881	21.7	21.2	1.27
1882	22.9	21.7	1.15
1883	25.5	20.3	1.07
1884	25.7	21.4	0.96
1885	25.9	19.	0.92
1886	26.2	19.	0.74
1887	28.0	20.	0.79

AV. rects. per ton-mile 1872, 2.58 cts.; 1873, 2.44; 1874, 2.07; 1875, 1.95 cts.

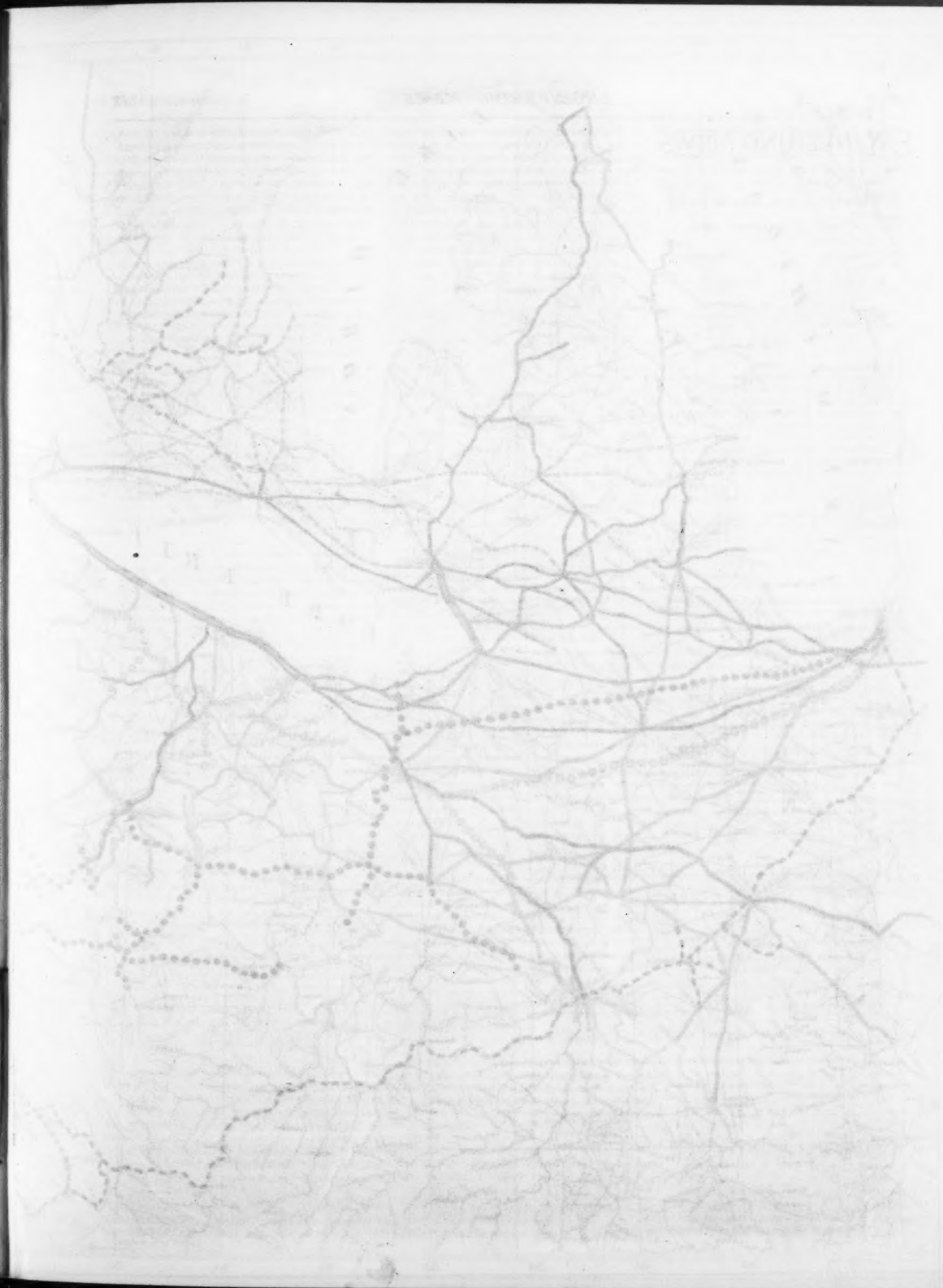
Average Number of Tons moved 1 Mile by Freight Engines INCLUDING SWITCH ENGINES, 1875-87.

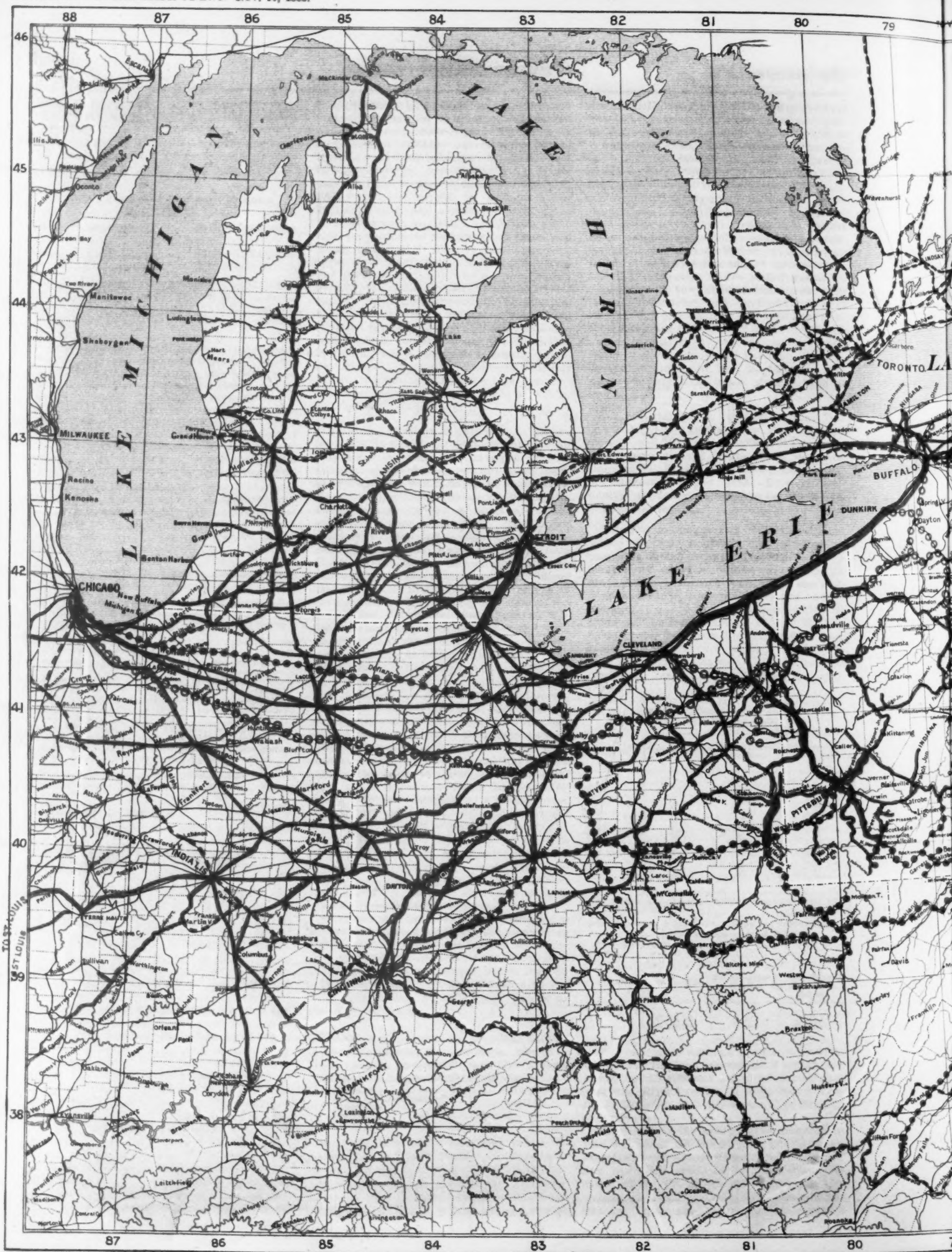
(The intermediate years omitted show a very even growth.)

YEAR.	Tons 1 Mile.	No. of Freight Engines.	Ave. Tons 1 Mile Each Engine.
1875	97,042,724	57	1,702,504
1887	181,849,188	50	3,636,982

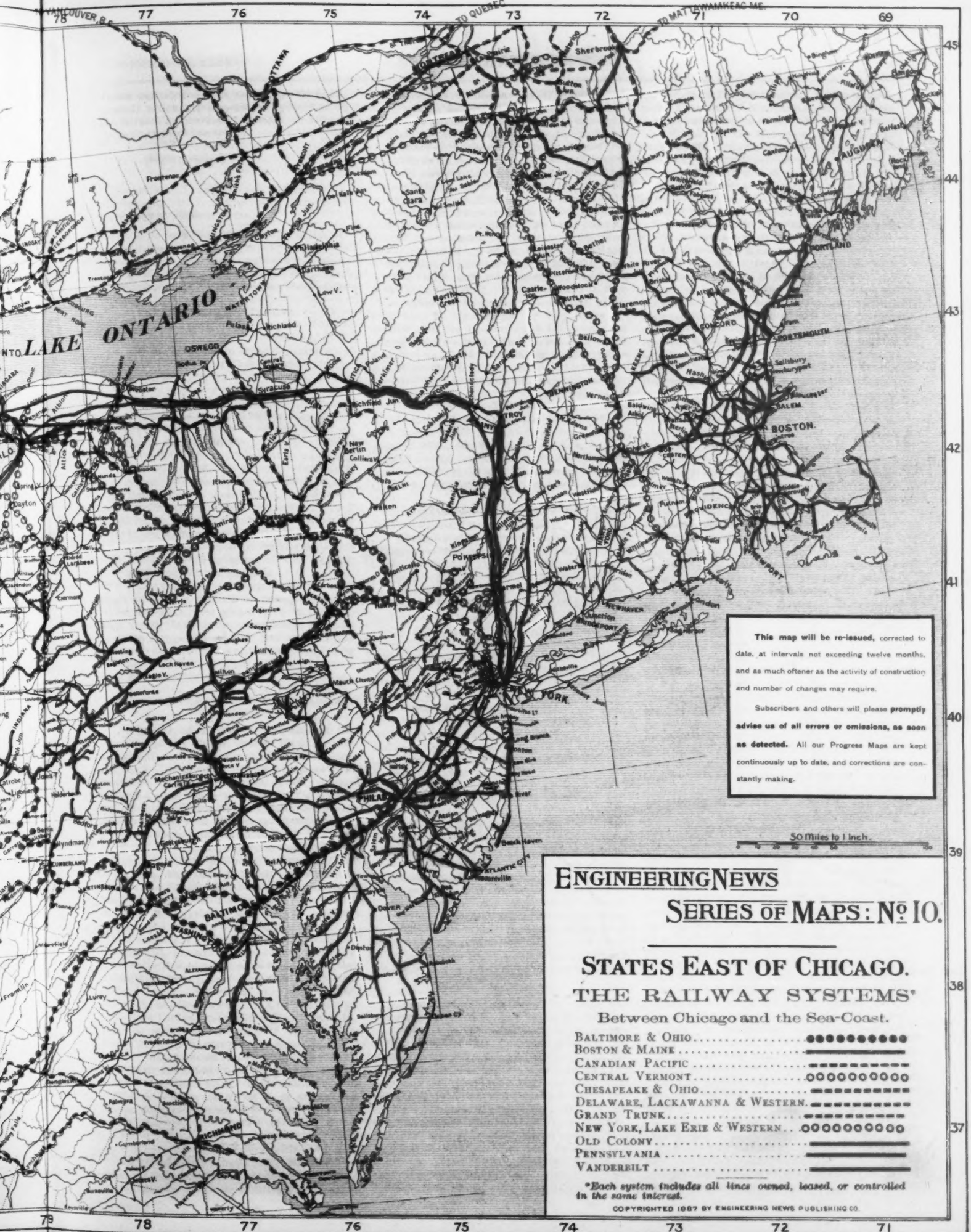
This enormous tonnage growth is in spite of the fact that the percentage of empty cars hauled on the different Divisions during last year was, River Division, 37.54 per cent.; Low Grade Division, 39.53 per cent.; Sligo Branch, 41.61 per cent.

The records of the world will be searched in vain, outside of this country, for another such example of marvellous progress in mechanical and operating efficiency as this table indicates, which we have come upon purely by chance, and used as a record in form convenient for ready use, in which the progress





CHAS. HART & SONS, LITH., 36 VESEY ST., N. Y.


LAKE ONTARIO
TO QUEBEC
TO MATTAWAMKEAG ME.
VANCOUVER, B.C.
PORTLAND
BOSTON
PHILADELPHIA
BALTIMORE
WASHINGTON
RICHMOND
ATLANTIC CITY
50 Miles to 1 Inch.
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ENGINEERING NEWS
SERIES OF MAPS: No 10.
STATES EAST OF CHICAGO.
THE RAILWAY SYSTEMS*
Between Chicago and the Sea-Coast.
BALTIMORE & OHIO
BOSTON & MAINE
CANADIAN PACIFIC
CENTRAL VERMONT
CHESAPEAKE & OHIO
DELAWARE, LACKAWANNA & WESTERN.
GRAND TRUNK
NEW YORK, LAKE ERIE & WESTERN.
OLD COLONY
PENNSYLVANIA
VANDERBILT
*Each system includes all lines owned, leased, or controlled in the same interest.
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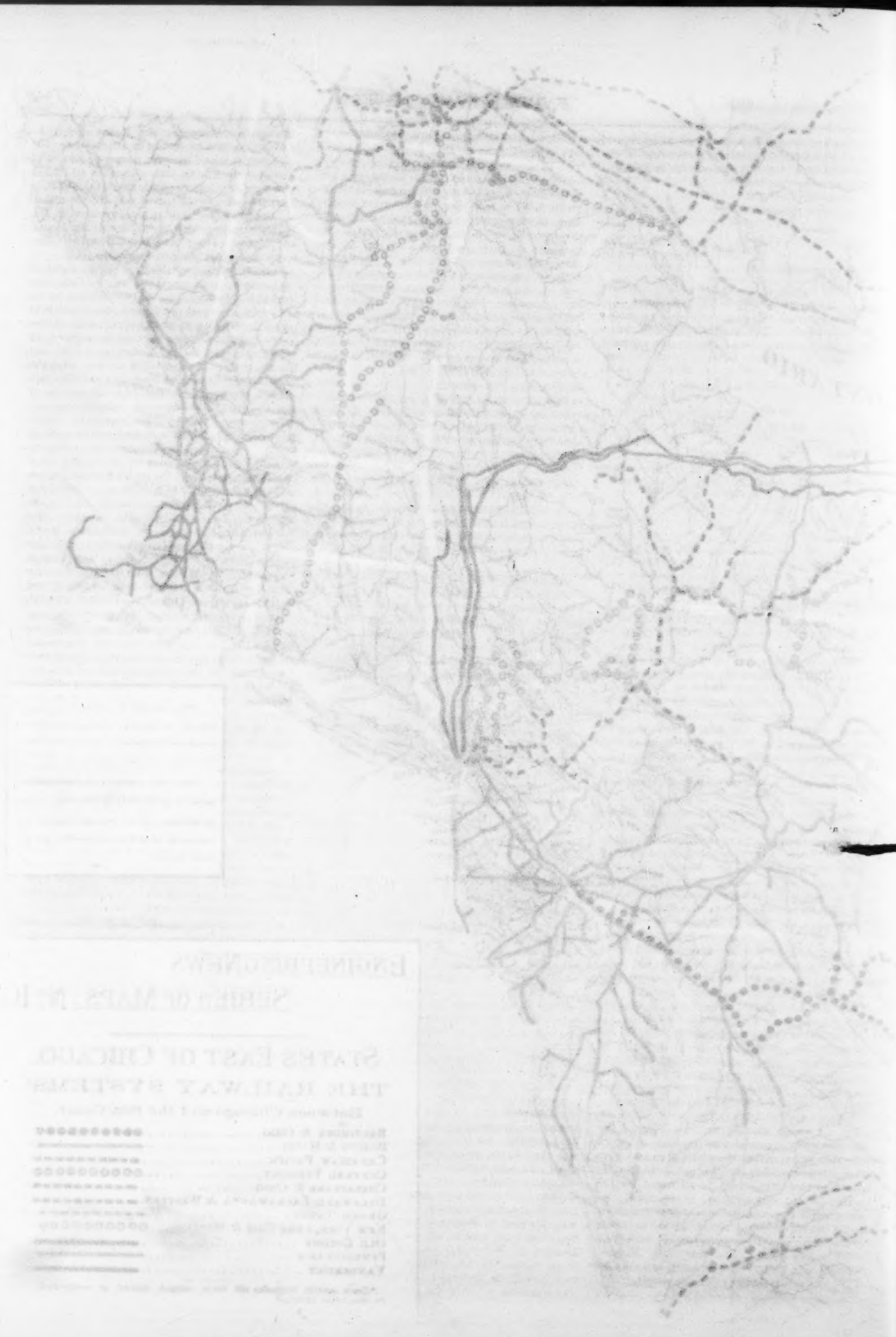


shown was *not* due to any change in the type of engine, which are almost exclusively of the old 8-wheel "American" pattern; as follows:

8-wheel "American" engines		32	
10 " engines		4	36
4 " switching engines		1	
6 " " "		13	14 50

Had only road engines been included in the above table the ton-miles per engine would have been 39 per cent. more.

IT will be seen from the above table that the ton-mileage per engine is now 2.14 times what it was 12 years ago, 7 less engines doing nearly double the work. Had this road been one of those introducing Consolidations, the increase would have been far greater; but the low grades and light traffic (only $7,000 per mile) of this road have so far prevented their use. That this has been accompanied by even greater economy in other departments is indicated by the fact that for the 1.96 cts. which was charged to move a ton a mile in 1876, 2.48 tons are now carried.

We do not ascribe the marvellous progress in cheap transportation which our railway records of the past 10 or 15 years show, and for which there is no parallel in any European country, wholly or chiefly to any superior competency or progressiveness, or to superior mechanical appliances. We cannot but believe that it is very largely due to these causes, but the chief cause is the sharp and free competition which exists here and (to anything like the same extent) in no other country on the globe. Still, when one compares such records as the above with the crab-like progress of the English railway system, either in rates or in locomotive performances, one cannot but feel that there is little in English locomotive practice which deserves to be copied here or perpetuated there. But on the other hand, when we come to compare terminal facilities, supervision of accidents, use of interlocking, and a few little matters of that kind we may well hide our heads in shame.

The Railway Systems between Chicago and the Sea-Coast.

The growth of the railway systems of the country and the radical change from the old [illegible] dent lines is still hardly comprehended by the general public. In a general way it is known that certain great systems control a large share of the country's traffic; but what is the extent and ramification of the great systems, what is their relative location, and what their relative advantages and disadvantages in the competition for business, are matters on which few well posted railway men, even, have correct ideas. To show the important systems lying between Chicago and the sea-coast we publish with this issue a map of the chief systems showing by distinct symbols the territory covered by each.

The current of traffic that flows between the commercial centers of the West and the markets and exporting points on and near the Atlantic seaboard, far outranks in its volume and value any other stream of commerce that the world has ever seen. Turn to our map of the whole United States, (ENG. NEWS, June 16, 1888) on which all the railway lines of the country are given, and note the close net-work of roads which covers the whole area east from the 100th meridian to the Atlantic, as far south as the Ohio river. If we could see the traffic which moves upon these roads, we should note the corn and wheat and live stock and a hundred other minor products being gathered up by buyers at the small collecting centers like Fargo, Hastings, Des Moines, Wichita and many other greater and smaller cities all over the upper Mississippi and Missouri valleys. From these cities it is shipped to the markets of Minneapolis, St. Paul, Sioux City, Omaha, Kansas City and St. Louis; and from these points, despite the various attempts to divert the stream directly to the markets of the East or the South, the great bulk of the traffic flows on to a common center at Chicago. Let us now consider the final destination of these products. By the census of 1880 the area included in New England and the Middle States contained a population of over 15½ millions, or over three-tenths of the total population of the country. A large proportion of this is located in the cities, and all of its food supply must be purchased. The farming population, too, is largely dependent for its breadstuffs upon the West. Now if we add to this 15½ millions the increase in population since 1880, also the population of the cities of Quebec and the eastern Canadian provinces and of the cities of eastern Virginia, it is probable that we should find for the total population of the North Atlantic region which forms a market for the agricultural products of the West, a total of not far from 20 millions. Add now to the volume of products required to supply this home market, the volume of export traffic which is carried on through the ports of Portland, Boston, New York, Philadelphia and Baltimore and we have some inkling of the magnitude of the current of commerce whose channels are shown upon our map.

The chief interest, therefore, in the railway systems east of Chicago centers in the trunk line through traffic, although each of the great systems, recognizing the truth of that cardinal motto of railway management,—*It is* ADDITIONAL *traffic that pays profits*,—have built and bought branches and feeders until the bulk of the local, as well as the through traffic is carried by them.

The term railway system is a somewhat indefinite one, for the bond which causes two railway corporations to work together in more or less harmony may be of many sorts and shades of strength. For our present purpose, however, we have included in a "system" all lines owned, leased, or controlled in the same interest, meaning by the latter term, such control by ownership or guarantee of securities as will cause the controlled line to be operated in harmony with the main company against outside competitors.

We think it quite probable that many well informed railway men, even, will be surprised at the extent and ramification of some of the systems shown upon our map, especially the Vanderbilt, the Pennsylvania and the Grand Trunk. Of the 11 systems which we have been able to show upon the map without confusion, three, the Old Colony, Central Vermont and Boston & Maine are properly New England systems, the latter two, however, having an important influence on the trunk line situation. One, the Lackawanna, is chiefly important as a coal line, and the other seven are proper trunk line systems. We will consider each in detail, beginning at the north.

THE CANADIAN PACIFIC.

The present Canadian Pacific company was incorporated in 1881, and while the charter conferred upon the corporation large powers for extension, the main purpose of its creation was the completion of a railway to the Pacific coast through British territory. In 1884 the company obtained control of the Ontario & Quebec system and thus secured a direct line from St. Thomas to Smith's Falls, Ont., which was extended to Montreal last year. Grading has just been started on an extension from London to Windsor, opposite Detroit, and when completed the company will have a direct line from Detroit to Montreal, only 572 miles in length. How the company will reach Chicago from Detroit is one of the open questions. That it will secure an entrance to Chicago before many months, however, admits of little doubt. If the line secured is no longer than the Michigan Central, the total distance from Chicago to Montreal will be 858 miles. At Detroit connection is also made with the Wabash railway, a direct line to St. Louis, and also with the Flint & Pere Marquette system and several Vanderbilt roads.

The new Sault Ste. Marie route is north of the limits of our map; but as the Canadian Pacific is the chief actor in this scheme for diverting the wheat traffic of the Northwest away from Chicago, to the detriment of the trunk line roads running east from there, its importance should be understood. On our general map of the United States the strength of this route for competition with the Chicago lines is easily seen. Through its control of the Duluth, South Shore & Atlantic system, secured last spring, the Canadian Pacific reaches Duluth and the copper and iron mines of the north Michigan peninsula, connects with its avowed ally, the St. Paul, Minneapolis & Manitoba, and by the St. Paul & Duluth with the various lines centering at the Twin Cities. But a still shorter line to this important point is practically within its grasp. The St. Paul, Minneapolis & Sault Ste. Marie system, completed last year, extends from the Sault direct to the Twin Cities and thence westward into Dakota; and while nominally independent, it is believed to be largely owned by parties in the Canadian Pacific interest.

So much for the strategy of the "C. P." managers in tapping the collecting centers of the West. In scheming for eastern terminals they have no less important plans under way. The Atlantic & Northwest extension was begun two years ago, and is now almost finished to Mattawamkeag, Me., 325 miles east of Montreal. From here trackage rights are secured over the Maine Central and New Brunswick railways to a terminus at Moncton, 527 miles east of the St. Lawrence. From here the Inter colonial railway reaches the excellent port of Halifax, distant 815 miles from Montreal, and Louisburg on Cape Breton island. The distance of the latter port from Liverpool is but 2,300 miles, or 830 miles less than the distance from New York to Liverpool. Besides these eastern terminals, the Boston & Maine system, shown on our map, is ready to divert what traffic it can to Boston; and several Maine ports also expect to profit largely by their close connection with the system.

The prevailing impression that the Canadian Pacific is chiefly important as a transcontinental route, is thus seen to be erroneous. It is quite certain that the main line from the junction of the Sault Ste. Marie branch west does no more than pay operating expenses; and the line from Winnipeg west is operated at a heavy loss. While the managers may certainly expect with the growth of the country, better results from these divisions at some future day, they are now very wisely directing their chief efforts towards securing a share of the trunk line traffic, and it is plain that they have secured an important strategic position. In comparing this with the other trunk line systems, it is to be remembered that the company has received from the Dominion Government a total in gifts and subsidies of over *ninety million* dollars (ENG. NEWS Sept. 29, 1888, p. 253); and that with this solid backing they are enabled to enter the field of competition with a strong advantage over their rivals.

The series of articles descriptive of the system, now being published in this journal, will give the reader fuller information than we can spare space for here.

The total mileage of the system, including the extensions now under contract, is as follows:

	Miles.
Main line, Montreal to Vancouver	2,906
Main line, Detroit to Mattawamkeag, Me	897
Duluth, South Shore & Atlantic system	562
Other lines	1,285
Total mileage	5,650

THE GRAND TRUNK.

So much of public attention has been drawn to the Canadian Pacific system by its rapid growth and the gifts it has received from the Government, that the importance of the Grand Trunk system has been partly lost sight of by the general public. The Grand Trunk Railway Company was chartered in 1851; and despite the lavish bounty of the Government to its young rival, it is well able to sustain a part in the railway competition across the border no less important than that played by the Canadian Pacific. In 1879 the company secured control of the Chicago & Grand Trunk Railway, thus gaining an entrance to Chicago, and it now controls two other lines across the State of Michigan. In 1882 the Great Western system, 835 miles in extent, was absorbed; and during the present year, control has been secured of the Northern & Northwestern Railways, with a trackage of about 500 miles, and a new railway in Michigan, from Owosso to Muskegon. Reference to our map shows most clearly that the local traffic of western Ontario, the most valuable section of Canada, is almost wholly in the Grand Trunk's hands; and it is thought to be the intention of the managers to extend the Michigan system and add to the large local traffic which it has already secured in that State. Another smaller local system of considerable importance is operated in the southwestern corner of the Province of Quebec.

The eastern terminus of the Grand Trunk is at Portland, Me.; but hardly less important than its own line to the sea coast is the outlet it secures to Boston and New York over the Central Vermont system. The Grand Trunk company, though it does not control the Central Vermont, holds a large proportion of its capital stock, and the two lines are operated in harmony in the competition for through traffic. The route to Boston is *via* the Cheshire and Fitchburg Railroads; and that to New York is *via* steamer from New London, Conn.

The distance from Chicago to Montreal *via.* the Grand Trunk system is 837 miles, against 858 miles for the Canadian Pacific line to Windsor and thence over the Michigan Central. It will be noted that both these roads pursue a very direct course and evidently lie along the natural route for a railway line from the Great Lakes to the sea-coast, down the valley of the St. Lawrence. Work has begun on the double tracking of the main line between Montreal and Toronto, and about 45 miles of double track are nearly ready for use.

The total extent of the Grand Trunk system is now as follows:

Mileage east of Detroit and Port Huron	3,290
Chicago & Grand Trunk	335
Detroit, Grand Haven & Milwaukee	189
Toledo, Saginaw & Muskegon	96
Michigan Air Line and Detroit division	168
Total	4,078

THE VANDERBILT SYSTEM.

The bond of union between the corporations whose lines compose the Vanderbilt system, is of a different sort from that which binds together the lines of any other great railway system. This bond is simply the ownership of the majority of the stock of the component companies by the members of a single family. The first railroad to come under Commodore VANDERBILT'S control was the New York & Harlem, and then the New York Central & Hudson River. The system controlled by the latter corporation has now an extent of 1,447 miles, comprising besides the main line from New York to Buffalo and its famous parallel the West Shore, the New York & Harlem and various branches.

The Lake Shore & Michigan Southern system extends from Buffalo, N. Y., to Chicago, with branches to Detroit, Lansing, Jackson, Grand Rapids and other points in Michigan and Indiana. The notorious Nickel Plate line, which runs alongside the Lake Shore from Buffalo to Cleveland and thence *via.* Ft. Wayne to Chicago, was the most vicious instance of paralleling ever attempted. The Lake Shore secured a controlling interest in its stock in 1882. The Michigan Central system, with its Canada Southern line, forms a second route from Buffalo to Chicago through western Ontario, and operates a system reaching many important points in Michigan, with a line north to the Straits of Mackinaw. The Cleveland, Columbus, Cincinnati & Indianapolis, or "Bee Line" system, extends from Cleveland to St. Louis with branches to Cincinnati and Columbus, O. The Pittsburg & Lake Erie system extends from the Lake Shore & Michigan Southern at Ashtabula, O., south to Pittsburg and the coke regions in the Monongahela valley with a branch to the Pennsylvania oil fields.

The main line of the New York Central occupies a natural route for traffic to the sea coast from the Great Lakes. The valley of the Hudson forms for it a straight natural pathway, across the Appalachian Mountain system, which all the trunk lines south of it have to cross with heavy grades and a tortuous line. It is to be remembered that our map does not distinguish the additional tracking; and whereas the Canadian trunk lines still have but a single track, the Vanderbilt system has four tracks on the New York Central and two tracks on the West Shore, making practically a system of six tracks from Buffalo to New York City. There are also on the Lake Shore and the Michigan Central systems about 400 miles of double track. It is also to be noted that a large portion of the traffic over the Vanderbilt lines from Buffalo east, consists of goods brought by water from ports on the Great Lakes, and this accounts in part for the difference in capacity of the system east and west of Buffalo. The distance from Chicago to New York by the Vanderbilt system is either 978 miles by the Michigan Central, 982 miles by the Lake Shore & Michigan Southern, or 965 miles by the Nickel Plate. The latter road, however, is not used for through traffic at present.

The most important of the extensions to the Vanderbilt system now pending is the South Pennsylvania, from Pittsburg east to Harrisburgh, Pa. Although projected as an independent line and competitor of the Pennsylvania Railroad, the VANDERBILTS are largely interested in it, and if completed, it will be quite certain to become a part of their system.

We have not shown upon our map the great system west of Chicago controlled by the VANDERBILTS. This western Vanderbilt system exceeds in mileage, though not in traffic, the lines controlled by the family east of Chicago and St. Louis. The Vanderbilt lines west of Chicago are those included in the Chicago & Northwestern system, the Chicago, St. Paul, Minneapolis & Omaha system, the Fremont, Elkhorn & Missouri Valley system, and the Sioux City & Pacific Railroad; a total of 7,150 miles, located in Illinois, Michigan, Wisconsin, Minnesota, Iowa, Nebraska, Dakota and Wyoming. The line in the latter territory which now terminates at Casper, 1,095 miles west of Chicago, is being steadily pushed westward, and is confidently believed to be bound for the Pacific coast. Taking this line in connection with the Vanderbilt line from Chicago to New York, 982 miles in length, and we have the distance by rail between the extreme eastern and western points of the whole Vanderbilt system as 2,097 miles.

The mileage of the Vanderbilt lines east of Chicago and St. Louis is as follows:

New York Central & Hudson River system	1,447	miles
Lake Shore & Michigan Southern	1,341	"
Michigan Central	1,337	"
New York, Chicago & St. Louis	513	"
Cleveland, Columbus, Cinn. & Ind.	730	"
Pittsburg & Lake Erie	136	"
Total east of Chicago and St. Louis	5,713	"
Add Vanderbilt lines west of Chicago	7,150	"
Total Vanderbilt system	12,863	"

What stock and bonds of other railway lines than the above, the members of the VANDERBILT family are accumulating in their safes, is something which the general public has no means of finding out. But to hold the controlling interest in the property enumerated in the above table, should certainly be a sufficient achievement to satisfy the descendants of a man, whose total wealth, seventy years ago, was but nine thousand dollars. The market value of the properties controlled is nearly if not quite $1,000,000,000. It includes a good many leased and controlled branches not owned, but apart from this the VANDERBILTS probably have a majority control; and this is but a part of their fortune, which doubles by compound interest every 12 to 15 years.

THE NEW YORK, LAKE ERIE & WESTERN.

This system, still popularly known as the "Erie", extends from New York to Chicago, with a system of branches in western New York, northern New Jersey, and feeders tapping the coal fields of Pennsylvania. The Chicago & Atlantic Railway was built in 1882 and extends from Chicago east to Marion, O. It is controlled through the ownership of a large part of its securities. The New York, Pennsylvania & Ohio system, which is operated under lease, reaches Cleveland, Springfield & Youngstown, in Ohio, and has on some divisions a heavy local traffic. The system of branches of the Erie near New York City is growing more profitable every year and will increase still faster when a bridge or tunnel crossing of the North River is secured. The company many years ago secured control of 36,000 acres of coal lands in western Pennsylvania, and is also largely interested in anthracite coal fields in the Wyoming Valley. The total coal traffic of the line for the last fiscal year was about 11 million tons. The original western terminus of the system was at Dunkirk, N. Y.; but the attempt to build a rival city to Buffalo at this point had to be given up, and the principal Lake Erie terminus is now at Buffalo. As seen by our map, the route of the line from eastern Ohio to New York City is extremely tortuous. Despite the fact that it does not make the long detour *via* Albany which lengthens the route of the New York Central, its distance from New York to Chicago is almost exactly the same, or 986 miles against 982 miles by the Lake Shore. Between New York and Buffalo the distance is 423 miles by the Erie against 441 miles by the New York Central. Remembering that the Erie has far heavier grades than its competitor, its relative disadvantage on through traffic is apparent.

The total mileage of the system is as follows:

New York Lake Erie & Western system	1,273	miles
New York, Penn. & Ohio system	531	"
Chicago & Atlantic system	249	"
Total mileage	2,053	"

THE PENNSYLVANIA.

The eastern termini of the Pennsylvania system are New York City, Philadelphia, Baltimore and Washington; and it reaches St.

Louis and Chicago on the west. It has termini on Lake Michigan at three other points, Muskegon, Traverse City and Mackinaw Straits. It has five terminals on Lake Erie, at Toledo, Cleveland, Ashtabula, Girard and Erie, and its Northern Central line terminates on Lake Ontario at Sodus Point. The system consists of two grand divisions, one containing the lines running east and the other those west of the junctions at Pittsburg and Erie, Pa. The eastern system consists of a main line from Pittsburg to New York City, *via* Altoona, Harrisburg and Philadelphia; the Northern Central railway from Baltimore to Lake Ontario: the Philadelphia, Wilmington & Baltimore system, from Philadelphia to Baltimore and Washington, with a system of branches in the States of Maryland and Delaware; an extensive system of branches covering the southern two-thirds of New Jersey; the Philadelphia & Erie system from Erie to Williamsport, Sunbury and Wilkesbarre, Pa.; and an extensive system of main lines and branches in the coal, coke and oil regions of Pennsylvania.

The system west of Pittsburg and Erie comprises two main lines from Chicago to Pittsburg, the Pittsburg, Ft. Wayne & Chicago and the Pittsburg, Cincinnati & St. Louis and Chicago, St. Louis & Pittsburg; the Vandalia line to St. Louis; the Grand Rapids & Indiana, from Richmond, Ind., north through Michigan to the Straits of Mackinaw; and a network of lines in northeastern Ohio and in central Ohio and Indiana.

All the main line from New York to Pittsburg is double track, and for a large part of the distance four tracks are now in use. Of the Pittsburgh, Ft. Wayne & Chicago main line, about one-fifth has been double tracked, and about 75 miles has been double tracked on the "Panhandle" line.

The route of the main trunk line across the Allegheny mountains, and in fact for the whole distance from Harrisburg to central Ohio, is hardly less crooked than the Erie. It gains in distance very appreciably over its competitor, however, having a run of but 912 miles from Chicago to New York *via* the Ft. Wayne line, or 951 miles *via* the Chicago, St. Louis & Pittsburg and the Pittsburg, Cincinnati & St. Louis. The heavy grades on the line, however, tend to offset its advantage in distance over the Vanderbilt routes, and the latter would be able to transport freight and passengers as cheaply or more cheaply than the Pennsylvania if it used as heavy engines.

The coal and coke traffic of the system is something enormous. The company has complied with the Pennsylvania laws, and its coal mining interests are now in the hands of auxiliary companies; but they are nevertheless managed in the interest of the system and furnished the Pennsylvania lines in 1887 a traffic of 2½ million tons which sold for nearly 8½ million dollars,

The total main track mileage of the system by States is as follows:

New York	106 miles	New Jersey	739 miles.
Pennsylvania	2,850 miles	Delaware	227 miles.
Maryland	446 miles	Va., W.Va. & D. of C.	113 miles.
Ohio	1,393 miles	Indiana	1,064 miles.
Illinois	228 miles	Michigan	419 miles.

The total mileage of the system is as follows:

	Mileage main track	Total trackage including additi'nal tr'ck and sidings
Pennsylvania Railroad lines	2,388	4,670
Northern Central "	381	692
Phila., Wil. & Balt. "	635	988
Other lines E. of Pittsburg and Erie	824	1,184
Pennsylvania Company lines	994	1,625
Pitts., Cinn. & St. Louis "	989	1,366
Grand Rapids & Indiana "	558	661
Other lines W. of Pittsburg and Erie	778	984
Total of whole system	7,525	12,170

THE BALTIMORE & OHIO.

The main line of the Baltimore & Ohio system extends from Philadelphia to Chicago. It runs through a mountainous section in the States of Maryland and West Virginia, and reaches the Ohio river at Wheeling. A branch reaches Lake Erie at Sandusky and others tap the Ohio coal fields. A line runs from Cumberland, Md., through southwest Pennsylvania to Pittsburg and thence to a junction with the main line at Wheeling, tapping the Monongahela coke regions. A branch runs south to Harrisonburg, Va., and there are a few branches in Maryland and West Virginia. As seen on our map, the main line is the most crooked and indirect of all the trunk lines. The distance from Chicago to Philadelpeia is 925 miles against 822 miles by the Pennsylvania, and the road is in no such condition to carry a heavy traffic as is the Pennsylvania. The distance from Chicago to Baltimore is 853 miles.

Of the main line between Baltimore and Wheeling, about two-thirds has been double-tracked and there are a few miles of double track on the division west of the Ohio river. On the main line from Washington to Philadelphia, double track has now been laid for nearly the whole distance. The disadvantage at which the line is placed in regard to through traffic from its length and heavy grades is evident, and its local traffic has never been of great amount. The three systems lying north have succeeded in building up a number of thriving cities along their route; but the Baltimore & Ohio touches scarcely a city of size anywhere on its main line, and those which it does reach it has taken little pains to favor. The coal regions which lie adjacent to its line in West Virginia it has never tried to develop, although for 35 years it has had practically a monopoly of the railway communication of the northern part of that State. The chief reasons why the company was for so long able to pay steady dividends of eight and ten per cent., were its ability to charge high rates for such local traffic as it had, and the fact that it has indulged in stock watering to a much less extent than any of its competitors. The large amount invested in the line from Baltimore to Philadelphia, which has not yet proved a very paying property, were a chief cause of the sudden suspension of dividends and collapse in the price of the stock which occurred in 1887.

An important move in connection with its competition for trunk line traffic is the extension of the system to New York City. A traffic contract has been made with the Philadelphia & Reading, and trains are to be run *via* the Bound Brook line of that company, the new bridge across the Arthur Kill, and the Staten Island Rapid Transit railway to a terminus on the north shore of Staten Island, where a ferry connection is had with New York City only 15 minutes longer than that by which the Pennsylvania reaches the city across the North River. By this route the distance from Chicago to New York City will be about 1,040 miles, or 128 miles more than by the Pennsylvania line. Handicapped thus in its competition for the through trunk line traffic, it is probable that no great effort will be made to secure any large share and that the principal efforts of the company will be devoted to developing the main line from Washington and Lexington to New York as an outlet for the Southern railway systems.

The total mileage of the system is as follows:

Lines east of Ohio river	1,217 miles
Lines west of Ohio river	589 "
Total mileage	1,805 "

THE CHESAPEAKE & OHIO.

This system, the newest addition to the competitors for the trunk line traffic, extends from Chicago *via* Indianapolis, Cincinnati, Charleston, W. Va., and Richmond, Va., to a sea-coast terminus at Newport News, Va. It is composed of the Chesapeake & Ohio Railway, extending from Newport News west to the Ohio river at Ashland, Ky., the Richmond & Allegheny Railway, forming a second line from Richmond west to Clifton Forge, Va., the Maysville & Big Sandy Railway, from Ashland to Cincinnati, which has been built during the past two years and is now almost ready to open for traffic, and the Cincinnati, Indianapolis, St. Louis & Chicago, or "Big Four" line, from Cincinnati to a junction with the Illinois Central at Kankakee, Ill., over which road trains enter Chicago. The Chesapeake & Ohio and Richmond & Allegheny roads have just been taken from a Receiver's hands, but are said to be in fair condition. The system is all single track. The grades of the line are very favorable all the way from Chicago to Ashland, and from this point across the Alleghenies are believed to be more favorable than on the Baltimore & Ohio or Erie. A heavy local traffic is growing up along the line through West Virginia by the development of the mineral resources of that State.

The distance from Chicago to the sea-coast at Newport News is 943 miles. The line will be ready for through traffic as soon as the bridge across the Ohio river at Cincinnati is ready for trains and will probably be formally opened early in 1889. The President of the new system is Mr. M. E. INGALLS, whose proven ability as a pushing railroad manager warrants the belief that the line will prove no unimportant competitor of the older trunk lines. The total mileage of the system is as follows:

	Miles.
Chesapeake & Ohio lines	644
Richmond & Allegheny lines	257
Cin., Ind., St. L. & Chicago	414
Total mileage	1,315

Of the other systems lying between Chicago and the sea-coast, we have shown on our map the Delaware, Lackawanna & Western, Boston & Maine and Central Vermont systems because of their importance to a comprehensive review of the trunk line situation. The description of these lines and of the other important systems, with a summary of the salient points of interest in connection with the trunk line systems we must defer to a following issue.

North Americans in Chili.

The Americans who have just secured the goodly slice of railway work in Chili, elsewhere noted, are to be congratulated upon their enterprise and success. They have taken the contract in the face of active competition with European syndicates; and the fact that the Government which awards it is beyond doubt one of the most intelligent, the most progressive and the most stable in its finances of any of the South American republics, speaks well for their choice of Americans and American methods, and for the successful termination of this truly colossal enterprise.

The credit of Chili is unimpeachable, a rare circumstance in South America, it has a surplus of $20,000,000 in its treasury, and these railway bonds can be negotiated at par. The Chilians have shown a conservative spirit in managing their finances, and they have been well called "the Yankees of South America" for their progressive spirit and pluck in peace or war. As a consequence, the conditions surrounding this contract are creditable to themselves as a nation, and most reassuring to

the citizens of our own country, who are staking their capital and experience on an enterprise which will doubtless greatly benefit both parties to this contract, as it should.

The principals in the American syndicate are well known in the United States as extensive builders of public works, and this is particularly true of the Union Bridge Co. This later company is itself a syndicate formed some years ago by the union of some of the most favorably known bridge building firms in the country. The recently completed Poughkeepsie bridge over the Hudson, and the Hawkesbury bridge, in New South Wales, the last with unprecedentedly deep foundations, give warrant of their skill and experience and of the capital necessary for handling works of magnitude.

Not the least pleasant feature in this event is the evidence it gives of the fact that Americans are no longer content to leave the construction of great public works, in other countries than their own, solely in the hands of more enterprising English, French, German or Belgian firms. In the past we have had work enough to do at home, and have plenty of it still, to occupy the majority of our contractors; and this advantage over the other nations referred to doubtless accounts for the scarcity of American ventures in foreign lands. But this very abundance of work, of a most difficult and varied character, has trained men and accumulated capital that should give our contractors vast advantages in any honest and intelligent competition anywhere; and if money and fame are to be made, there is no valid reason why Americans should be counted out.

But such work in foreign climes does not only mean financial gain to the individuals directly interested; its benefits are much more widely spread. American workmen means the introduction of American plant, tools and products of all kinds, not only those actually used in the construction of any particular piece of work, but in the every day life of the people, who thus have an opportunity to see our products used and test their merits as compared with clumsier, higher-priced or totally unsuited articles with which they have been made familiar by nations earlier in the field. From the characteristics of the people and their standing as a nation, Chili is a particularly favorable spot for a propaganda of this nature, and we rejoice at the present opportunity, and shall be much disappointed if the successful termination of this railway system does not find many other American firms of producers almost equally benefited with the original syndicate.

PERSONAL.

E. M. WILKINS has been appointed engineer of the Virginia Steel Co.

LUCIUS J. N. STARK, Commissioner of Docks, New York City, died Nov. 6.

C. G. ECKART has been appointed General Manager of the Central Iowa.

Superintendent WEYMOUTH, of the Idaho division of the Northern Pacific, has resigned.

HON. MAHLON D. SPAULDING died at Boston, Mass., Nov. 3, at the age of 61. He was a director of the Union Pacific and the Boston & Albany.

WM. HUNTER, an engineer engaged on the Norfolk & Western R. R., has been appointed Resident Engineer of the Atlanta & West Point, Western & Alabama, and Selma & Mobile railways, with offices at Atlanta, Ga.

COUNT ZETHELIUS and CARL ALEX HOLM, assistants to the Chief Engineer of the Swedish Royal Railway Company, have been sent to America by the Swedish Government to inspect the railway systems of this country—the management, construction of road-beds, the manufacture of locomotives, coaches and cars, and all details pertaining to railway traffic. Just now they are making a general examination to get an idea of the extent of our railway service before going into the statistics and minutiæ which they will require to make a complete report of their tour. They express themselves as astonished at the development of the railway system in the United States, which they pronounce more nearly perfect than that of any European country.

GEORGE G. SPECHT, C. E., a frequent contributer to this journal several years ago, died recently in San Francisco, Cal. Mr. SPECHT was born in Eutin, Holstein, Germany, April 19, 1851, and graduated at the Gymnasium of his native town. After serving in the German army in the Franco-Prussian war, he graduated in civil engineering in 1874 at the polytechnic school of Graz. He saw professional service on the Austrian N. W. R. R. and the St. Gothard tunnel and in 1879 went to San Francisco, in which neighborhood he was connected with various engineering enterprises. He was engineer of the Sutro tunnel from 1879 to 1881; engineer of the Sutter Co. Land Co., assistant engineer of the Spring Valley Water-Works, etc. Mr. SPECHT was one of the founders of and a hearty worker in the Technical Society of the Pacific Coast.

JOHN BOGART, State Engineer of New York, GEORGE W. BIRDSALL, Engineer Department Public Works, New York, and Messrs. SEE, BANTA, BROWN, SPRAGUE and BRUSH, the latter all practical masons and builders, were appointed on Oct. 24, by the Aqueduct Commission as a committee of experts to examine and report upon the character of the work along the line of the whole aqueduct. Mr. BIRDSALL has since resigned as noted below.

F. COLLINGWOOD, M. Am. Soc. C. E., has been appointed by the New Croton Aqueduct Commission as one of the board of experts to examine and report upon the condition of the masonry, etc., in place of Chief Engineer BIRDSALL, of the Department of Public Works, who declined to serve.

A. W. LANGE, C. E., died at Roanoke, Va., on Nov. 1. Mr. LANGE was a Swede by birth and commenced his engineering career on one of the Swedish railways in 1873, and remained in that service until about 1879. In 1881 he was Assistant Superintendent on the Hudson river tunnel, and in 1883 was Assistant Engineer on the Atchafalaya bridge on the Texas Pacific R. R. Since then he has been engaged on various works; notably, Chestnut bridge, Philadelphia; lighthouse, Delaware Bay; Assistant Engineer with BROWN, HOWARD & Co., and lastly on the Norfolk & Western R. R.

Scotch Engineering News.

Several railway projects—including the old subway scheme—were a short time since brought prominently before the public, but, up to the present time, nothing definite has come of any of these. Meanwhile, several extensive alterations are being made in the Glasgow district railway system with the view of facilitating public convenience. In connection with one of these, *viz.* the addition to the Bridge Street station, a long range of dwelling house tenements have had to be removed.

There is at present being erected at Greenock, (Glasgow Harbor), an extensive wet dock, and the Clyde Trust Navigation has just resolved to construct an additional dock at the same point of the river at a cost of $1,350,000. The substructure of the wall in connection with the dock being erected consists of concrete cylinders and the face-work of granolithic-faced concrete ashlar, which is made in moulds on platforms at the works.

There has just been completed at Motherwell, a short distance from Glasgow, a large engineering and bridge building establishment, which when in operation will give employment to a great number of hands. The town is situated in the very center of the steel manufacturing district and is one of the most prosperous burghs in the west of Scotland. It is here that the Messrs. COLVILLE'S steel making works are located, and the great Newton Steel Works are also situated near the same place.

Several large public works in this district have either made or are about to make considerable additions to their respective premises. These include the well known thread manufacturers, Messrs. Clark & Co., of Paisley, who have just bought a large plot of ground, with this view, and Messrs. Arrol, of Forth Bridge fame, who are making marked progress with that work. Up to the present time fully 40,000 tons of steel have been used in that colossal undertaking.

A new harbor is presently to be made at Portknockie, a village on the Banffshire coast. Despite great natural impediments, great progress has been made with the operations during the 15 months that have elapsed since the work was begun. The harbor, for which $50,000 was subscribed, is designed to meet the requirements of the fishing populace in that district.

The commercial world here is just now "agitated" over a current statement that the Scotch iron masters are about to form themselves into a combination for the purpose of regulating the production and price of iron. It is supposed that there is some truth in the rumor, but the realization of the scheme is more doubtful.

Prof. GREENWOOD in his presidential address at the opening of the Sheffield Technical School, a few days ago, devoted his remarks to the subject of locomotion by water, road and rail. He dealt mainly with the development of the railway and canal systems and speaking of electricity as a motive power, he said that while not of opinion that electric propulsion would extend to our main lines, he was by no means sure that in a few years time we should not have to record a rapid application of electro-motors to locomotion, and a possible check to steam locomotives on branch railways.

The Glasgow International Exhibition, which opened on May 8th will be closed on Nov. 10. Nearly 5,000,000 persons have visited it up to the present date.

PUBLICATIONS RECEIVED.

In commenting in a late issue on the scarcity of modern literature on the construction of the spiral arch we unintentionally overlooked a very clear and concise treatise on this subject by JOHN L. CULLEY, C. E. It was published as No. 87 of the Van Nostrand Science Series, under the title of "Treatise on the Theory of the Construction of Helicoidal or Oblique Arches."

Ohio Mining Journal, October, 1888. This number of the official organ of the Ohio Institute of Mining Engineers contains the address of President W. H. JENNINGS, and the following papers: "School of Mines, Ohio State University", by Prof. N. W. LORD; "Early Working of Coal," by Capt. J. L. MORRIS; "History of Mining Legislation in Ohio," by ANDREW ROY; "Ohio's Mineral Display," by R. M. HAZLETINE; "Fire Clays of Five Mile Creek," by ELLIS LOVEJOY; "Fan Ventilation," by T. B. BANCROFT.

Quarterly Report of the Chief of the Bureau of Statistics Washington, D. C. Pub. Doc. pp. 1154.

Besides the other usual statistics of this publication as to imports, exports, immigration and navigation, this volume is interesting as containing a full abstract of the tariff on all articles under the various laws since 1789 to 1888, which is perhaps not as interesting reading matter as it would have been before Nov. 6, but which has great permanent value. We abstract from a long table the following statement of imports which may be interesting.

	Free	Dutiable	Total	Av. expense	Duty including free
1860	73,741	279,875	353,616	19.85	15.82
1870	20,141	415,818	435,958	47.06	42.23
1887	234,221	451,099	692,320	47.10	31.02

The Canadian Pacific Railway.

V.

ROLLING STOCK AND TRAIN SERVICE.

The enterprising spirit which has characterized the entire management of the Canadian Pacific Railway is shown in nothing more conspicuously than in the character of the rolling stock, especially of the passenger trains. It was seen at once that, to create a paying traffic for the line, at least for the trying first decade, no little reliance must be placed on securing by competition a liberal slice of the transcontinental American traffic, and therefore it might fairly be claimed that enterprise and public spirit had less to do with the excellent service on the transcontinental trains than bare business necessity, such as has proved a sharp enough spur to make even the "Wagner" Palace Car Co. (which we might perhaps better spell with a V) give at last, after a sufficient dose of experience, almost as good service as the Pullman Co. But fortunately, the Canadian Pacific has besides its long main line a great system of branches in the more thickly settled eastern Canada, which was purely local, which demanded only a very ordinary service to give the people as good as they ever had before, and where its only competitor was the sleepy Grand Trunk, which had been quite content to do everything in a second-

class way, and claimed that it could not afford to do better, until driven by the Canadian Pacific competition to improve its car service, run its trains on time, and otherwise pay more respect to the comfort and feelings of the public.

Yet the service on these minor lines is in some respects even better than on the transcontinental trains, and therefore, while it would be absurd to suppose that the Canadian Pacific train service would be as good as it is had it not been "business" to make it so, because traffic had to be everywhere competed for; yet the credit is none the less for having perceived the necessity, for having known how to make it so, and for having taken the trouble and the money to do it, in the midst of many other pressing demands for both trouble and money. It is therefore no small credit both to Canada and to the management that the Canadian Pacific train service is on the whole, the best on this continent, and such we fully believe it to be, from personal knowledge of all the leading lines.

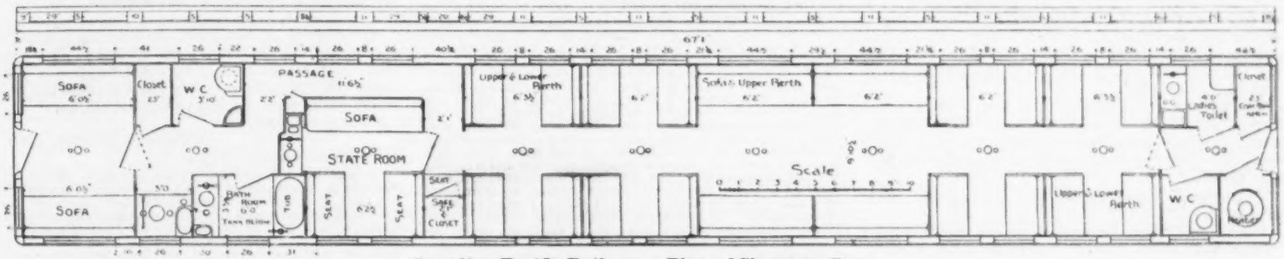
feature is a very desirable one for long journeys, as for changing linen or shaving.

Another decided improvement is the four sofa sections in the center of the car. It increases the spaciousness of the car, gives in practice every one who chooses, a chance to lie down during the day, and breaks the cheerless monotony of the long row of state-rooms. Cars making up throughout into sofas by day were never popular and long since went out of use, but a moderate admixture of sofas is quite another matter.

A still greater improvement on the ordinary Pullman is the character of the seats and upholstery. No drawing, unfortunately, can do justice to the great difference which exists in this respect. The Pullman upholstery and seats are well known to be anything but comfortable. The seats have little or no tip backward, the springs are hard, there is often a lack of rest for the arm, and in general they are really less pleasant for a long day ride than a good ordinary day car, except for the better air and

immigrant traffic, but by far the larger part of it is only in transit for the States through Canada. Thus, one train left Montreal with 7 car-loads of immigrants, picked up 8 car-loads more at Port Arthur, and was divided into two sections, entering Winnipeg with 17 cars; 9 car-loads left the same day for Dakota, and 5 car loads went through to the Pacific, nearly every man being bound for Washington and California. Three bad crops in succession almost stopped immigration to Manitoba, and the good crops of this year and last have not yet started it up in any great volume, although in the aggregate, of course, a good many are going in.

Another great peculiarity of the Canadian Pacific is that all the passenger cars go through from Montreal to Vancouver, nearly 3,000 miles and nearly a 6 day trip. They have a thorough cleaning at Winnepeg, and inspection at many points, but in practice it is not found that there is any special difficulty in making this long run. The cutting out of cars is the rare exception. The whole passenger



Canadian Pacific Railway.—Plan of Sleeping Car.

The most distinctively peculiar and advanced feature of the Canadian Pacific rolling stock is the transcontinental sleeping car, a ground plan of which we give herewith, and which will be seen at a glance to differ materially from the ordinary "Pullman" in many details, while in many others which cannot be seen at a glance nor at all from the ground plan, it differs as greatly, all the differences being decided improvements. These cars are not run on all the local trains; but rather cars approximating more closely to the ordinary Pullman type; we do not know why, for although there is not the same necessity for the special conveniences of this car in the local service, yet some of the most important of them are desirable for all service, and do not involve any sacrifice of room.

This is especially the case with the end smoking compartment, which is a broad spacious stateroom, giving an unobstructed view both to the rear and to the side, instead of the close, contracted box with a view on one side only which is provided for smokers in the Pullman cars, while the end of the car is given up to closets and washstands and carefully obstructed so that only one man can look out to the rear, and he only by standing up, and peeking through a small hole in the ground glass end window in the door. Of course this end compartment loses much of its special advantages when another car is coupled on at the rear, and in that fact we suspect we have the reason why the Canadian Pacific type is not more common; but even then it is vastly more comfortable, roomy and cheerful than the Pullman, without really taking up any more of the car. It is a fact, however, that when a private car is coupled on at the rear of a Canadian Pacific transcontinental train there is a good deal of grumbling and disappointment among the passengers, who thus lose a great enjoyment of their trip, an unobstructed view over the whole country, whereas with the Pullman passenger it makes no difference. He is cut off from all such pleasure any way by the construction of the car. It is perhaps an unfair surmise, but it cannot but occur to one that managing officers like to ride in private cars, which always have the end state-room feature; like to be at the end of the train, and do not like to have passengers grumbling. Be this as it may, the Canadian Pacific is the only line on this continent where the ordinary passenger who pays money to ride, enjoys this pleasant prerogative of the dead-head officials.

The bath-room is another novel and pleasant feature of these cars. It wastes little room, if any, as the tub becomes a storage table for baggage when not in use, and the washstand would have to be provided anyway, while the separate compartment

greater room. The Canadian Pacific sleeping car seats are a triumph of care and skill. The upholstery is as nearly perfect as it can be made, and the form of the seats is such that they can be ridden in in comfort all day long, and are really luxurious.

Finally, the general design and finish of the car is almost without exception in the most excellent taste. Instead of the staring bright colors which are so generally used, the upholstery is of some soft and quiet neutral tint; the metal work is of antique brass instead of nickel-plate; the marble dark instead of white, and the woodwork and head-linings light colored and quiet, although exquisitely finished, looking as if they had been designed by an architect or an artist, as they no doubt were, rather than by a cabinet-maker anxious to show his skill. We do not forget the many admirable cars like the Pennsylvania parlor cars, and some few of the Pullmans and Wagners, of which much the same may be said, but as a whole we think it beyond dispute that the Canadian Pacific are by long odds the superior of any cars in this country in their combination of comfort and good taste. We should have mentioned also that the exterior woodwork of these and all the other passenger train cars which run on the Canadian Pacific is of unpainted mahogany, which is not only much handsomer than any painted surface, but is claimed to be in the end as economical.

Who deserves the chief credit for the design and arrangement of these cars we did not ascertain, and it would be invidious to inquire. Doubtless it does not wholly belong to any one. They were built by the Barney & Smith Manufacturing Co., of Dayton, O., and doubtless to them belongs the chief credit for their admirable finish and design. The main features of the ground plan, probably, came from the Canadian Pacific management. In only two features does it seem possible to improve them. The end platforms might well, for so long a trip, be provided with traps to cover the steps, as is usual in private cars, and the stateroom be provided with a closet, as in some of the Pullmans, which does not necessarily sacrifice much room.

The day coaches on many of the Canadian Pacific trains are also exceptionally comfortable, being provided with the excellent Forney car seats and otherwise comfortably finished. On the transcontinental trains, the "first-class" is really a decidedly second-class car, all the passengers who keep clean or care to, taking the sleeper, except for a hundred miles or so in Manitoba. The immigrant sleeping cars are of much the same design as those used on the American Pacific roads, differing in minor details only. The Canadian Pacific has a very large

equipment is mounted on 40 in. steel-tired wheels, and the running gear and springs are well designed for durability and easy riding.

The C. P. operates its own sleepers, as every road should which has any respect for its common stockholders, and shows a handsome credit balance from them. It also, of course, runs its dining cars, which we shall refer to in a following issue.

RAIL-JOINTS.

We find that we were not entirely correct in regard to the present status of rail-joints on the Canadian Pacific when we lately spoke of them. A high official of that company writes us:

"The only plain fish splices in the Canadian Pacific Railway are on the two sections built by the Government, and for a short distance west of Winnipeg which had been laid with rails taken from the partially completed Government line. Since 1881, and this practically covers all of the company's work, every rail has been laid with 26-in. angle splices. On our principal lines we are now using 40-in. angle splices, and we contemplate increasing this length to 44 ins.

"I will not trouble you now about the question of square and broken joints, but some day when we have an opportunity to discuss the matter I hope to be able to convince you that except on lines which are fully ballasted before they are opened for traffic, broken joints are almost impracticable. I have had a very good opportunity to test that question on prairie lines, which for a good many years had to be worked with no other ballast than top loam.

"There are three or four short sections on our line where the joints are battered, but these sections were laid with a lot of exceptionally soft rails, with which we got "stuck." They were laid on rock embankment and were more or less battered before the ballasting was finished. This is due to the quality of this particular lot of fifteen miles of rails and not to the splices, or being laid with square joints."

While this was in a personal communication, not intended for publication, we publish this part of it in order to give both sides of the question as to even vs. broken joints, and to show that, whether the even joints be really better practice or not, they were adopted from conviction that they were. This may at least be said, that if they are anywhere justifiable it is on roads having only "mud" ballast. For extreme cases of such track, where there is a normal rain fall, we admit that even joints are preferable; but the C. P. is not in that position on 2,500 out of its 3,000 miles of main line, and for at least 1,000 miles of its main line it is in as good shape to use broken joints as any road would be, and we are convinced would have a better and more easily maintained track. However, doctors will differ, but it is a fact that the tendency throughout this country is strongly towards broken joints for track.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers.—At the regular meeting on Nov. 7, the abstract of the report of the Committee on the "The Proper Relation to Each Other of the Sections of Railway Wheels and Rails" was informally presented, the report having already been printed and sent out to members as one of the regular numbers of the "Transactions," it having been regarded as constructively submitted at the Convention The report was briefly explained by MR. A. M. WELLINGTON, and discussion was deferred. The committee appointed at the Convention at Milwaukee to consider a resolution proposed by the Standing Committee on "Standard Time," to the effect that a treatise by MR. SANDFORD FLEMING on "Time and its Notation" be recommended as a text book for schools was presented; the committee considered it beyond the province of the Society to recommend any one treatise or to suggest that the subject be taken up by schools, and therefore recommended that the resolution be rejected. This was the sense of the meeting, and the report of this committee was accepted. A paper by MR. FRED BROOKS on "Time Reform", which was principally a criticism of MR. FLEMING'S treatise and which contained much useful information on the title subject, was read by the Secretary. MR. GIESELER, a visitor, described his scales for railway turnouts, giving the frog angle and lead without computation.

The Secretary announced that WM. J. MCALPINE, JULIUS W. ADAMS and GEORGE S. GREENE, all Past-Presidents, had been elected Honorary Members of the Society. The death of SPRINGER HARBAUGH, Fellow, was announced.

No proposed amendments to the Constitution were presented.

The following were declared elected as members:

JACOB NEFF BARR, Supt. of Motive Power, C. M. & St. P. Ry., Milwaukee, Wis.

CARROLL PHILLIPS BASSETT, Newark, N. J.

WILLIAM CAIN, Prof. of Mathematics and Engineering, South Carolina Military Academy, Charleston, S. C.

WM. CRAWFORD, Sault Ste. Marie, Ont., Canada.

GEO. BLINN FRANCIS, Prin. Asst. Engr., N. Y. P. & B. Ry., Providence, R. I.

HENRY NEWTON FRANCIS, Res. Eng., Fruit Hill Reservoir, Providence, R. I.

JAMES WALTER GRIMSHAW, Res. Engr. of Water Supply Works, Sydney, Australia.

GEO. RICHARDSON HARDY, N. Y., N. H. & H. Ry., New Haven, Conn.

FRANKLIN RIFFLE, Oregon & Washington Territory Ry., Wallula, Wash. Ter.

BENJAMIN BURGH SMITH, U. S. Asst. Engr., 6th Lighthouse District, Charleston, S. C.

FRANK SHERMAN WASHBURN, Engineer, Union Stock Yard & Transit Co., Chicago, Ill.

New York Railroad Club.—The next regular meeting of the club will be held at its rooms, 113 Liberty St., New York, Nov. 15, 1888, at 7:30 P. M. The subject before the meeting will be "Freight Train Brakes" and a paper will be read by JAMES HOWARD, of the Beales driver brake, on driver brakes in connection with freight train brakes. H. H. WESTINGHOUSE, of the Westinghouse air brake, and J. H. SLADE, of the Eames vacuum brake, will also be present, and present the merits and progress of their systems. This matter of freight train brakes is now commanding the attention of leading railroad men, and is one of the great questions now before them. It is thought by many that the time is not far distant when all trunk lines will adopt a train brake for freight trains. Persons interested are invited to be present and take part in the discussion. The rooms will be lighted by the American Lighting Co.'s regenerative railway car lamp.

C. A. SMITH, *Secretary.*

The American Society of Naval Engineers is the latest technical society formed. It has for a purpose the general advancement of the professional interests of engineers and ex-engineers of the Navy. It is proposed to have branches at the various navy-yards and stations for the discussion of professional subjects, etc. The annual dues are $5, and anyone desiring to enter the Society can do so by signifying his intention and enclosing the amount stated to Assistant Engineer R. S. GRIFFIN, U. S. N., Navy Department, Washington, D. C. The by-laws can also be secured from the same source.

THE Maritime Canal Co. of Nicaragua has introduced a bill into the Vermont Legislature, through representative HAZEN, asking for an act of incorporation. It is substantially the same bill passed by the U. S. Senate, but never allowed to come to a vote in the House. The incorporators are the same in both cases. The capital stock is set at $70,000,000; and it is expected that as soon as the bill passes, subscription books will be opened for the sale of stock in Montpelier, New York and in Nicaragua.

CONSTRUCTION NEWS.

RAILROADS.

East of Chicago.

Existing Roads.

Lime Rock.

ROCKLAND, Me., Nov. 1, 1888.

EDITOR ENGINEERING NEWS:

This road at Rockland, Me., is used to transport limestone from the quarries to the kilns and is now in operation, reaching 15 or 20 kilns. Some 60 kilns will eventually be reached. The total length of tracks is about 5 miles, laid since July 1. The work is done by the company, no contracts being let. The line carries freight traffic only. WM. T. COBB, is President.

PARKER SPOFFORD, *Chief Engineer.*

Lake Shore & Michigan Southern.—This company built last year a short line from Doughton Jc., O., to Sharon, Pa., about 7 miles, and some work has been done on a further extension of the line to Sharpsville, parallel to the Nypano. By an agreement just closed with the Nypano managers, the Lake Shore secures running rights over the Nypano from Sharon to Sharpsville, and obviates the necessity for constructing a parallel line.

Tobique Valley.

ANDOVER, Victoria Co., New Brunswick, Nov. 6, 1888.

EDITOR ENGINEERING NEWS:

The Tobique Valley Railway is to run from a junction with the New Brunswick Railway at Perth Center, up the St. John and Tobique valleys and ultimately to Campbellton on the Intercolonial Railway. The company was chartered in 1885 and a preliminary survey was made two years ago, from Perth to Plaster Rock, 28 miles. The line has a Dominion subsidy of $6,400 per mile, to obtain which it is necessary to locate the road with maximum curves of 7° and grades of 1½ per cent. The country admits of a good location being secured. There is considerable heavy rock work on the line. The road will open up some valuable gypsum quarries and a fertile agricultural region. The line has been located and the right of way secured for 14 miles. Active work on construction began in September, and about 14 miles are now being graded. Tracklaying will probably begin by May 15 next; and the section from Perth to Trout Brook be ready for traffic by September, 1889. JNO. E. STEWART, Andover, N. B., is President of the company and C. L. B. MILES, is Chief Engineer.

H. M. NIBBLER.

Tilton & Belmont.—

BELMONT, N. H., Oct. 31, 1888.

EDITOR ENGINEERING NEWS.—

Enough of the stock of this company has been taken by citizens of Belmont and parties interested to furnish capital for building the road. The citizens of Belmont will pay all land damages. Contract for construction was closed on Oct. 5, with D. HAZLETON of Boston and O. M. GALLUP of Vermont. The line will probably be finished ready for traffic by July 1, 1889. Grading and bridging are to be completed by Jan. 1, 1889.

E. C. BEAN, *Secretary.*

Baltimore & Ohio.—A circular issued by John A. Hambleton & Co., of Baltimore, bankers, who have been prominently connected with the management of this system, refers to the rumor which has gone out that this system is soon to come under the control of the Richmond & West Point Terminal; and says that Baltimore citizens can rest assured that the road will never be sold to parties not directly interested in the welfare of that city. It states, however, that the fact that Drexel, Morgan & Co. have a voice in the management of the Baltimore & Ohio through their connection with the reorganization which took place last year, and have also been appointed financial agents of the Richmond & West Point Terminal system, gives some foundation to the report.

Lehigh Valley.—A report that this company has secured a trackage right over the Erie to Attica, N. Y., proves to be unfounded. It is stated that the project for building the Buffalo & Geneva Railroad, for which surveys were made last winter, has not been abandoned and is likely to be carried out next year.

Cincinnati, Hamilton & Dayton.—It is reported that this line, the Dayton, Ft. Wayne & Chicago, and the Wheeling & Lake Erie are likely to be consolidated, and that negotiations have already begun.

Leamington & St. Clair.—This road has been opened for business from Leamington, Ont., north to Comber, on the Michigan Central Ry., a distance of 15 miles. LEWIS WRIGHT is President, and H. TAYLOR, Superintendent. The general offices are at Leamington.

Grafton & Upton.—The 5-mile extension of this Massachusetts road to West Upton will probably be open for business Dec. 1.

Pennsylvania.—Contractor SHANLEY has begun work with a large force of hands near Brunswick St., Jersey City, removing the embankment preparatory to putting in the foundations for the elevated viaduct through Jersey City. It is not thought that there will be any further opposition to the elevation of the tracks.——The semi-annual dividend on the common stock, voted by the directors of the company on Nov. 1 was 2½ per cent.

Canadian Pacific.—The gross earnings for the first nine months of the year 1888, amounted to $9,371,490, and the working expenses to $7,078,551 leaving the net earnings at $2,292,878. The net earnings for the same period last year were $2,096,902. Thus the present year shows an increase of $195,776.

New York, Mahoning & Western.—A press report from Findlay, O., states that officials of the Atchison, Topeka & Santa Fé are examining this partly built line from Ft. Wayne, Ind., to Findlay O., and intend to operate it as an eastern outlet. This story has probably about as much foundation as the statement found in one of our exchanges that "the Atchison has just completed an extension to Lake Superior," a story which originated, we suppose, from a short line of the Atchison system just built to Superior, Neb., a point 600 miles from Lake Superior.

New Projects and Surveys.

Hudson Suspension Bridge & New England—

38 WALL ST., New York City, Nov. 2, 1888.

EDITOR ENGINEERING NEWS:

This railroad is to run from Turners, on the New York, Lake Erie & Western, across the Hudson river at Fort Clinton, thence east to Connecticut State line at North Salem, with a New Jersey connection from Fort Clinton, a total distance of about 60 miles. The line runs across country and requires much heavy work. There will be a single span bridge across the Hudson river, and a tunnel at Bull Hill. Surveys are completed, a large amount of right of way secured, and contracts have been let for the Bull Hill tunnel and approaches to the bridge. The enterprise is in the interest of all roads east and west of the Hudson river; and contracts for the Highland bridge have been made with the New York & New England, dated Sept. 18, 1888, and with the New York, Susquehanna & Western, dated Aug. 10, 1888. The contract with the Lehigh & Hudson River is formulated and that with the Erie is formulating. All the money required for the preliminary work has been secured, and it is expected to proceed with construction and have the line open for traffic by July, 1890. EDWARD W. SERRELL is President of the Company.

McKeesport & Bessemer.—This company, whose incorporation was noted last week, intends to build a railway about 4 miles in length, which includes a bridge across the Youghiogheny river and will afford the Pennsylvania system an entrance to McKeesport, Pa.

Northern Maine.

GARDINER, Me., Nov. 3, 1888.

EDITOR ENGINEERING NEWS:

Surveys have been made of the Northern Maine Railroad from Mattawamkeag via Needway, Sherman, Patton, Island Falls, Dyer Brook, Oakfield, Smyrna, New Limerick, Houlton and Littleton to Monticello, about 115 miles; with a line from Houlton to Bancroft about 35 miles in length. Parties are now at work securing the right of way and local aid has been secured to the amount of $85,000. Contracts will probably be let next season. Hon. GEO. P. WESTCOTT of Portland is President.

FREDERIC DANFORTH, *Chief Engineer.*

Penobscot & Aroostook.—This company was organized on Nov. 2 by the choice of WM. T. PEARSON, of Bangor; J. B. MULLEN, CHAS. W. MULLEN, CHAS. H. MONTAGUE, of Old Town; SAM. L. MONTAGUE, of Cambridge, Mass.; EUGENE H. CLAPP, of Boston, and HORATIO J. GILBERT, of Milton, Mass., as directors. The capital stock was placed at 50,000. The directors elected EUGENE H. CLAPP, President; SAM. L. MONTAGUE, Treasurer, and CHAS. W. MULLEN, Clerk.

Washington County.

38 *Wall St.*, NEW YORK, Nov. 2, 1888.

EDITOR ENGINEERING NEWS:—

The Washington County railroad is projected to run from Greenwich, N. Y., to Rutland, Vt., a distance of 56 miles. The line will have easy grades and no features of especial difficulty. Right of way in New York State is all contracted for, and enough local aid has been secured to pay for it. The enterprise is backed by private capital, but a traffic contract with the New York Central has been formulated. A contract for construction has been let to A. D. FOX and his associates. EDWARD W. SERRELL is President and J. S. CHASE, 38 Wall St., is Chief Engineer.

Gloucester & Atco.—Bids are soon to be asked for building this New Jersey road, as the surveys are nearly completed. The buildings along the line in Gloucester are being removed and work is to be pushed through the winter. The company proposes to have built some heavy transfer boats, able to make their way through any ice floe likely to be encountered in the Delaware. GEO. A. MORRIS of Gloucester is Chief Engineer.

Dexter & Piscataquis.—The officers of this new Maine company are JOSIAH B. MAYO, Foxcroft, President; L. P. EVANS, Clerk; E. A. THOMPSON, Treasurer.

Carabasset & Canadian.—A meeting for the organization of this company will be held at North Anson Me., Nov. 15.

SOUTHERN

Existing Roads.

Richmond & West Point Terminal.—The plans and prospects of this system still form a chief topic of interest in Southern railway circles. The possible control of the Baltimore & Ohio system has been referred to above. The negotiations with the owners of the controlling interest in the Atlantic Coast Line system have not yet been closed, and rumors that other consolidations are meditated continue to circulate. The Georgia Pacific, Western Railway of Alabama, and some of the companies in which the Central Railroad & Banking Company of Georgia, is interested are to lose their nominal independence and will be leased to the Richmond & Danville company.

Maysville & Big Sandy.—The Ohio River bridge Cincinnati is being rapidly pushed, and will probably be ready for trains by Jan. 1.

Richmond & Chesapeake.—This company, which began work last June on the construction of a tunnel under Eighth St., in Richmond, Va., and proposed to build a railroad to Wicomico, on Chesapeake bay, has suspended operations. R. E. O'BRIEN, of New York, was Chief Engineer of the company, and J. M. LUM, of Richmond, was Engineer in Charge. The contractor was J. C. CARPENTER.

Louisville, St. Louis & Texas.—It is expected that this road, along the Kentucky bank of the Ohio river, will be open for business from Louisville to Owensboro, by Nov. 18, and to Henderson by the middle of December.

Americus, Preston & Lumpkin.—This Georgia road is to be widened to standard gauge. The surveys for the extension west to Montgomery, Ala., are nearly finished.

Versailles & Midway.—Work has been resumed on the extension of this road from Midway to Georgetown, Ky.

Louisville Southern.—Two corps of engineers are at work on the surveys for the extension to eastern Kentucky and grading is in progress in Jessamine county.

New Projects and Surveys.

Atlanta & Alabama.—Two corps of engineers are to be put in the field at once to locate this proposed line from Atlanta, Ga., to Selma, Ala., about 180 miles. Harrison & De Witt, of Atlanta, are the engineers in charge of the work. L. E. O'KEEFE of Atlanta is at the head of the enterprise.

THE NORTHWEST.

Existing Roads.

Gardner, Coal City & Northern.—This line has been completed from Walker to Coster, Ill., *via* Minooka and Coal City, a distance of 31.75 miles.

Milwaukee, Lake Shore & Western.—The Rhinelander branch has been extended from Rhinelander to Lac du Flambeau, Wis., a distance of 27 miles.

Northern Pacific & Manitoba.—President W. C. VAN HORNE of the Canadian Pacific writes to the Toronto *Mail* defending the company's position in the matter of the disputed crossings of the Portage extension of this system in Manitoba, against an attack of Prof. GOLDWIN SMITH. According to this statement, the cardinal feature of the difficulty is that the Provincial Government of Manitoba, which is building the Portage extension, is proceeding on the assumption that its power in the matter of making such crossings as it chooses of the Canadian Pacific line is unlimited, and that it is not obliged to appeal to the railway committee of the Dominion Government at Ottawa for a permit to make the crossing, in the same manner as a private company. Mr. VAN HORNE says:

"Why did not Mr. Attorney General MARTIN adopt the usual course in such matters, and, months ago when his surveys were made, give notice to the Canadian Pacific Company of his desire to cross its lines at certain points, and make the usual application to the Railway Committee of the Privy Council? Had he done so all questions could have been disposed of long before he could begin track-laying. But he wished the Dominion of Canada and the world at large to clearly understand that he was no vassal, but that he was "a law unto himself", and that he would scatter all opposition like chaff."

"Now, the right of way of the Canadian Pacific Co. is its own property, bought and paid for with its own money, and, subject only to certain laws in the public interest, it is just as sacred to the purposes of the company as is Mr. GOLDWIN SMITH'S hearthstone sacred to his uses. Leaving all technicalities and constitutional questions aside, is it consistent with Anglo-Saxon ideas of right that Mr. Attorney-General MARTIN should demand and attempt to force a crossing on the property of the Canadian Pacific Co. without color of law and without any legal process whatever under the laws of the Dominion, or even under the laws of his own Province? Would an individual be expected to submit to anything of the kind, or would Mr. GOLDWIN SMITH expect any other railway company than the Canadian Pacific to submit to it?

"And if the Canadian Pacific Co. ventures so far as to question the right of the Red River Valley Railway to cross its lines at all, or if it should even question the constitutionality of an Act of the Manitoba Legislature, why should it not? When the Canadian Pacific seeks to cross the tracks of the Grand Trunk Ry. with competing lines, and the Grand Trunk Co. questions its power under its charter, or even the validity of the charter itself, does anybody denounce such opposition as dishonorable? Certainly not. The officers of the Grand Trunk Railway would be guilty of neglect of duty did not they seek by every proper means to protect the property entrusted to their charge from injury."

The Railway Committee of the Privy Council have referred the matter to the Supreme Court of Canada, for decision. A special session of the Manitoba legislature has just been convened to take some action of retaliation, it is supposed, upon the Canadian Pacific.

Duluth, South Shore & Atlantic.—The projected extension from L'Anse, Mich., to Ontonagon, has been given up.

New Projects and Surveys

Eau Claire, Mississippi & Lake Superior.—

Smith Block, EAU CLAIRE, Wis., Oct. 3, 1888.

EDITOR ENGINEERING NEWS:

This railway is projected to run from Winona, Minn., *via* Independence, Wis., Eau Claire, Chippewa Falls, Flambeau and Mason to Ashland, on Lake Superior, a distance of 250 miles. Between Chippewa Falls and Independence, 55 miles, the line has been surveyed and 38 miles are located. Work is light; the max. grade is 40 ft. per mile; max. curve, 4°. The county is mostly heavily timbered and the line is projected in the lumbering interest. There will be two short tunnels, 800 ft. About one-third the right of way has been secured. R. F. WILSON is President, and C. E. BUSSELL, is Chief Engineer.

JNO. F. ELLIS.

Union Transfer Company.—This company has been chartered in Illinois for the purpose of developing the STICKNEY purchase—4,000 acres recently bought in the town of Lyons. The idea is to make the place a sort of railway clearing house by means of a system of transfers to connect with each of the different roads entering the city. The land lies near Summit, and is about 15 miles from the Chicago Court House. It is in close proximity to the Chicago & Alton, the Santa Fé, the Grand Trunk, and the Wisconsin Central roads. ANDREW CRAWFORD, of Lake View, THOS. H. THUMBULL, of Chicago, and others, are the incorporators. The capital stock is $2,000,000. Work is to begin in the spring.

Sioux City Rapid Transit.—

SIOUX CITY, Ia., Oct. 29, 1888.

EDITOR ENGINEERING NEWS:

The railway is to run from Sioux City, to the suburb of Morning Side, a distance of four miles. The surface portion of the line is finished, and work on the elevated structure will be commenced as soon as the ordinance granting a franchise is passed. It has been favorably acted upon at its first and second readings. Capital for building the elevated structure is all secured. The line has no grades exceeding 1½ per cent. It will carry only passenger traffic at present. E. C. PETERS, *President.*

THE SOUTHWEST.

Existing Roads

St. Louis, Arkansas & Texas.—The grading is completed on the extension from Malden to Delta, Mo., and most of the track has been laid. At Delta connection is made with the St. Louis, Iron Mountain & Southern line of the Missouri Pacific, over which through trains will be run to St. Louis.

San Antonio & Aransas Pass.—A construction train has begun work laying the track on the extension from the Brazos river to Houston, Tex., and the line will be finished early next month.

Missouri, Kansas & Texas.—The receivers have announced their intention of completing the Dallas & Waco railway from Dallas to Lancaster, graded last year, at the earliest date possible. If the court permits, the whole line to Waxahachie will be finished and put in operation.

Atchison, Topeka & Santa Fé.—A reduction of salaries of 10 per cent. to apply to all employés receiving more than $600 per year, except those in the train service and mechanical departments, has been ordered, to take effect Nov. 1.——The Strong City & Ellinor line has been extended from Concordia, Kan., to Superior, Neb., 40 miles.——Connection is made at the latter place with an extension of the Fremont, Elkhorn & Missouri Valley division of the Chicago & Northwestern, recently completed.

Memphis, Little Rock & Indian Territory.—Grading has been started at a point near Hot Springs, Ark., on this line, which it is reported is backed by the Louisville & Nashville and the Memphis & Little Rock companies, and the HUNTINGTON syndicate into the bargain.

New Projects and Surveys.

Pratt, Salt Plains & Rio Grande.—

PRATT, Kan., Oct. 27, 1888.

EDITOR ENGINEERING NEWS:

The Pratt, Salt Plains & Rio Grande Railroad is projected to run from Pratt, *via* Sun City and Nescatauga, Kan., to El Paso, Tex. The road will run through a fine farming and grazing country and will have for its principal sources of traffic, stock farm products and salt. The railway is an independent enterprise. Local aid will be voted all along the entire line in Kansas. The balance of the money will be furnished as needed. Surveys will probably begin Mar. 1, 1889. T. E. SIMPSON is President and ———McDOWELL is Chief Engineer.

GEO. H. SAUNDERS, *Secretary.*

Interstate Railway Construction Co.—This company has been chartered to build railway lines in any State in the Union by C. E. GALLAGHER, of Dodge City, Kan., D. L. WILLIAMS, NOAH HARDY, D. M. FROST, HILL P. WILSON and others, with a capital stock of $100,000. The headquarters are at Denver, Col.

Dennison & Washita.—President W. B. MUNSON has called a meeting of the directors of this company to be held at Denison, Tex., Dec. 1, to vote an increase of the bonded indebtedness of the company from $16,000 to $20,000 per mile.

Gate City Lumber Co.—This company has been operating a lumber railroad from Texarkana, Ark., south. The line has been extended from time to time, and is now to be incorporated as the Texarkana & Shreveport Railroad and pushed on to Shreveport, La.

ROCKY MOUNTAIN & PACIFIC.

Existing Roads.

Union Pacific.—Blake, Boissevain & Co., of London, are offering to investors an issue of $4,400,000 five per cent. bonds, secured by a mortgage on the Union Pacific Lincoln & Colorado Railway, a consolidation of the Salina, Lincoln & Western, and the Oakley & Colby railways in western Kansas. The line may eventually be extended through western Kansas to Colorado, though it is not intended to build beyond Colby for the present. The final surveys for the extension to Lake City, Col., down the Gunnison river are in progress. It is reported that running rights have been secured over the new line of the Montana Central Railway, and though trains will be run to Helena, Montana.

Oregon Pacific.—In the suit of this company against contractor GEO. W. HUNT, the jury awarded the plaintiff damages to the amount of $76,243. MR. HUNT took a contract on the line in 1886; and after doing a large amount of work and receiving no money, abandoned the contract.

The suit was brought by the railroad company to recover $150,000 damages for not completing the contract. MR. HUNT put in a counter claim for $160,000, of which $80,000 was for work done and $80,000 for damages incurred in hauling materials and supplies into the mountains and having to haul them out again.

A similar suit between the company and contractor NELSON BENNETT is pending and it is anticipated that the decision will be against the company, Messrs. HUNT and BENNETT anticipate that they may be obliged to take possession of the road to satisfy their claim. In that case they will examine the prospects of the enterprise, and if advisable, push the road to completion. The company has now 600 to 700 men at work on the road.

San Francisco & Northern Pacific.—Chief Engineer F. K. ZOOK and Superintendent H. C. WHITING have just completed a reconnoissance of the proposed extension from Ukiah to Eureka, Cal., about 180 miles. The route is considered feasible for a railway and no engineering difficulties of magnitude were encountered.

Vancouver, Klickitat & Yakima.—Grading has been resumed on this Washington Territory railroad.

Pasadena.—This company has taken possession of the line formerly known as the Altadena railway, from Pasadena to Altadena, Cal., 7 miles, which has been operated during the past year by the San Pedro, Los Angeles & Utah Ry. Co. A. B. MANAHAN is General Manager.

Carson & Colorado.—This company has filed a mortgage to secure bonds for $1,620,000. It is supposed that the funds obtained by the sale of the bonds will be used to build the proposed extension to Los Angeles.

Seattle, Lake Shore & Eastern.—About 50 miles of track have been laid on the main line from Seattle, W. T., east. Tracklaying is in progress on the eastern division and about 15 miles have been laid from Spokane Falls west. On the Seattle & West Coast division track is laid to a point about 25 miles north of Seattle.

Oregon & Washington Territory.—Surveys are in progress for the proposed extension from Walla Walla to Waitsburg.

Chicago, Rock Island & Pacific.—The new line to Colorado Springs, and thence to Denver over the Denver to Rio Grande Ry. was opened for business on Nov. 3.

New Projects and Surveys.

Bay City & Harbor Navigation Company.—This company proposes to build a belt railway at San Francisco, Cal., along the water front, to be used by all railway companies entering the city. A franchise has been applied for. The company will expend $2,500,000 in the construction of the road. W. H. H. HART of San Francisco is interested in the enterprise.

Proposals Open.

Electric Light Plant.—Electric light system for business places and domestic purposes. The borough will take a large number of lights for street purposes. W. PERRY City Clerk, DuBois, Pa.

Street Work.—Curbing and guttering. FRED SCHATTNER, City Clerk, Wichita, Kan. November 12.

City Work.—Asphalt block pavement; 24-in. tile sewer; 1,000 cu. yds. of gravel. H. W. BANNISTER, City Clerk, Syracuse, N. Y. November 12.

Bridge.—Two new spans in bridge across Big river; also 2 iron piers. S. D PAXTON, Clerk of Supervisors, Mendocino, Cal. November 12.

Street Work.—Paving and grading streets. LOUIS WAGNER, Director of Public Works, Philadelphia, Pa. November 12.

Dredging.—Improving the channel of the Seneca river and the old Bear Race in the village of Waterloo. JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y. November 13.

Walks.—Cement and flat work walks at Longview Insane Asylum. FRED RAINE, County Auditor, Hamilton, O. November 17.

Sewer.—Vitrified pipe drain, 8 and 6-in. pipe and Ys, receiving basins. THOS. J. LANAHAN, Clerk of Board of Contract, Albany, N. Y. November 19.

Bridge.—Lift bridge over the Erie canal at North Ferry St., Albany. JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y. November 20.

GOVERNMENT WORK.

Breakwater.—About 425 ft. of pile and stone breakwater for the U. S. marine hospital at Chicago, Ill. THE SUPERVISING ARCHITECT, Treasury Department, Washington, D. C. November 13.

Sidewalks; Lighting.—Brick sidewalks, November 15. ——Lighting barracks by carburetted air gas. November 16. Capt. GEO. H. COOK, Depot Quartermaster, U. S. A., David's Id., N. Y.

Sewerage.—Furnishing all materials and labor and laying 10,766 lin. ft. of sewerage at the military post near Denver; salt glazed vitrified pipe, 1,165 ft. of 4-in., 6,010 ft. of 6-in.; 3,575 ft. of 8-in., 16 ft. of 10-in.; 71 fittings; 27 cast-iron manhole covers; 43,000 hard burned brick. Plans and specifications on file. Capt. L. E. CAMPELL, Assistant Quartermaster, U. S. A., Denver, Col. November 19.

Revetment.—Revetting the banks of Wappoo Cut, S. C., with stone. Capt. F. V. ABBOTT, U. S. Engineer Office, Charleston, S. C. November 21.

Harbor Work.—Extension of harbor, piers and superstructures at Ontonagon, Mich. Major JAS. B. QUINN, U. S. Engineer Office, Duluth, Minn. November 22.

Dredging.—Wilmington harbor, Cal. Major W. H. H. BENYUARD, U. S. Engineer Office, San Francisco, Cal. November 24.

Barges, Etc.—Building 1 towboat, 2 snag boats, 2 drilling barges and 2 dumping flats. Capt. R. L. HOXIE, U. S. Engineer Office, Montgomery, Ala. November 26.

Dredging and Dam.—Dredging in harbors of Biloxi bay and Pascagoula river, Miss. Constructing dam in Pascagoula river. Major A. N. DAMRELL, U. S. Engineer Office, Mobile, Ala. November 27.

Dredging.—About 214,000 cu. yds. in Sandusky bay, along the line of proposed straight channel from Sandusky harbor. Major L. COOPER OVERMAN, U. S. Engineer Office, Cleveland, O. December 6.

Contracting.

Track Supplies.—The Little Bay Lumber Co., of Thornton, Ark., will build 3 miles of 36-in. gauge iron or steel track. A locomotive will also be purchased.

Lane Bridge & Iron Works.—P. E. LANE, of Chicago, Ill., is adding a new building 65x200 ft. to his works, and is also putting in additional machinery.

The Alameda Stone & Paving Co. has been incorporated at Oakland, Cal., by J. H. WOODWARD, B. NOYES, W. B. KING and others. Capital stock, $500,000.

The German Rock Asphalt Co. has been incorporated at Buffalo, N. Y., by R. J. GETZ, D. W. MCCONNELL, HERMAN KRAMER, and others. Capital stock, $15,000.

City Work.—Tampa, Fla., has voted to issue bonds for $75,000 for improvements.——At Baltimore, Md., a $5,000,000 improvement loan is proposed.

The Southern California Sewer Pipe Co. is building extensive works near Los Angeles, Cal., for the manufacture of salt glazed pipe, fire brick, etc. An electric light plant will be put in.

Government Work.—The $90,000 contract that Carkeek Bros., of Seattle, Wash. Ter., have for government work at Destruction Island, includes the lighthouse, dwellings, barns and houses, a line of railroad across the island, and the sewers and drains.

The Reliance Gauge Co., of Cleveland, O., reports the following orders for safety water columns: Reading Iron Works, Philadelphia, Pa., 32; California Electric Light Co., San Francisco, Cal., 10; six orders have been received from Australia and three from Mexico. Business is reported satisfactory.

Sewer.—*Dubuque, Ia.*—Contractor Murray, of Newark, O., has commenced work on his sewer contract. He will lay as much as possible of the 30-in. brick sewer this fall, and finish the rest of the contract in the spring. He is at work now on the levee in the southern part of the city. CHESTER B. DAVIS, of Chicago, is the Consulting Engineer.

Levees.—The following proposal for constructing the Hard-Times-Wilson levee, in Tensas parish, La., were opened Oct. 22, by Capt. D. C. KINGMAN, U. S. Engineer office, New Orleans, La.: John McGinty, New Orleans, 19 cts. per cu. yd.; John Scott & Son, St. Louis, Mo., 19½ cts.; E. P. White, New Orleans, 20 cts.; W. H. Swift, St. Louis, 23 cts.: J. S. McTighe & Co., Memphis, Tenn. 23¾ cts. The contract was awarded to John McGinty.

The Board of Commissioners of the 5th Levee District of Louisiana, at Tallulah, La., has received the following proposals for the Raleigh levee: E. P. White, New Orleans, 13 cts. per cu. yd.; J. Scott & Son, St. Louis, 14 cts.; A. P. Martin, Waterproof, La., 16¾, 17, 18 cts.; J. S. McTighe & Co., Memphis, Tenn., 17¾ cts.; K. H. Jeffries, Memphis, Tenn., 17¾ cts.; E. C. Manning, Aurora, Ind., 17 9-10 cts.; J. McGinty, New Orleans, 19½ cts.—Contracts have been awarded as follows: Raleigh levee, E. P. White, New Orleans, 13 cts.; Norwood to Cypress Point, P. Harnan, 12 98-100 cts.; Golden Grove levee, P. J. Tyrrell, 13 99-100 cts.: Lauderdale levee, A. L. Gervin, 13 cts.; Jesuits Bond levee, Martin Head, 13¼ cts.

It Pays to Advertise a Good Article.—The National Meter Company, of 252 Broadway, New York, believes in this principle thoroughly. And the water-works offices of the country, having had their attention drawn to the company's goods through the liberal advertising in ENGINEERING NEWS, have been buying until the figures are now up to 60,000, as advertised elsewhere. On Jan. 1, 1886, the number was 35,000. The company acknowledges its indebtedness to ENGINEERING NEWS as having very materially helped along this happy result.

The Laidlaw & Dunn Co., of Cincinnati, O., dealing in pipe, machinery, pumping plant, etc., has been awarded several medals at the Centennial exposition; one medal was for the standard "duplex" steam pump.

Lumber.—The Reliance Lumber Co., of Beaumont, Tex., has been awarded the contract for all lumber (about 9,000,000 ft.) for section houses, depots, trestles, etc., on the Southern Pacific extension from Victoria, Tex., to Beeville, 57 miles.

Water Filter.—The Jewell Pure Water Co., of New York and Chicago, has been awarded a special gold medal by the management of the Virginia Exposition, at Richmond, Va. The company did not exhibit in competition, but had a plant purifying 490,000 galls. of James river water daily for the use of the exposition.

Pipe Works.—Lacy, Ward & Co., of Los Angeles, Cal., have a contract to furnish the San Diego Flume Co. with 8 miles of 15-in. iron water pipe to bring the water from the La Mesa reservoir into San Diego, and will erect works at San Diego similar to those at Los Angeles. The works will be specially for this contract, but when that is finished sheet iron pipe will continue to be manufactured at both works.

The Carolina Oil & Creosote Co., of Wilmington, N. C., elected the following officers at its recent annual meeting: President, W. P. CANADAY; General Manager, J. N. SEBRELL; Secretary and Treasurer, WM. MAHONE, Jr.; Directors, WM. MAHONE, of Virginia; WARNER MILLER and GEORGE WEST, of New York; M. C. BUTLER, of South Carolina; J. F. DIVINE and R. E. HEIDE, of Wilmington, N. C.; E. R. BRINK, of Fernandina, Fla. A satisfactory report was presented as to the condition of the company.

Artesian Well.—The following proposals for sinking an artesian well have been received by the City Council, Scotland, Dak.; J. V. TEIBEL, City Clerk: H. W. Carter, St. Louis, $4 per ft. from 1 to 1,500 ft., furnishing everything; Sparks & Allen, Dundee, Mich., $2.50 per ft. from 650 to 1,000 ft.; $3 from 1,000 to 1,200 ft., $4 from 1,200 to 1,500 ft., city to furnish pipe; Bongard & Allingham, Mitchell, Dak., $3.50 per ft., 6-in. hole; M.C. Bullock Mfg. Co., Chicago, Ill., $10 per ft. for the first 200 ft., $11 for second 200 ft., etc.; American Well Works, Aurora, Ill. $2,500 for first 500 ft., $2,000 for the second and $2,500 for the third; Carr & Ritchie, Yankton, Dak., $4.50 per ft. to water bearing strata, in case granite is encountered $15 per ft. The contract was awarded to H. W. Carter.

Bridges. — *Seattle, Wash. Ty.*—The following bids have been received by LYMAN WOOD, County Commissioner: Thos. G. Bird, 2 spans of 65 ft. $8,750, $3.50 per ft. for trestle; McMahon & Son, $9,100, $3.53; Hoffman & Bates, 2 spans of 65 ft., $8,495 with wooden piers or $9,350 with iron piers, 1 span of 130 ft., $10,300 or $11,000; Pacific Bridge Co., 1 span of 130 ft., $11,000 on wooden or $12,400 on iron piers; California Bridge Co., 1 span of 130 ft., $13,350. The contract was awarded to Hoffman & Bates at $11,000 for 1 span of 130 ft. with iron piers.

Sacramento, Cal.—The Board of Supervisors has awarded the contract for a bridge across the Mokelumne river at Benson's ferry, to the American Bridge Co., of San Francisco, at $6,400. The other bidders were the Pacific Bridge Co., California Bridge Co., San Francisco Bridge Co. and E. E. Barry, of Elk Grove.

New Castle, Col.—The contract for the county bridge has been awarded to the Bullen Bridge Co., at $4,989.

Avondale, Ala.—The Southern Bridge Co. has contracts for 6 iron bridges in Jefferson Co.

Pineville, Ky.—The contract for the Straight creek bridge, 135 ft. span, has been awarded to the Louisville Bridge Co., of Louisville, Ky.

Brooklyn, N. Y.—The contract for the new Lullwater bridge at Prospect Park has been awarded to John Guilfoyle at $5,000.

Metal Markets.—*Structural Iron.*—Prices are about as follows: in Philadelphia, 2.10c. @ 2.15c. for bridge plate; 2c. @ 2.10c. for angles; 2.35c. @ 2.7c. for tees, and 3.3c. for beams and channels, iron or steel. Store prices are as follows in Chicago: angles, 2.35c. @ 2.50c; tees, 2.60c. @ 2.70c.; beams, 3.80c. Mill orders are taken at the following rates, f. o. b. Chicago: Angles, 2.20c @ 2.25c; universal plates, 2.22c., tees, 2.55c. @ 2.65c.; beams and channels, 3.40c. New York prices are; sheared plates, 2c. @ 2.1c.; universal mill plates, 2.1c @ 2.2c.; angles, 2.1c. @ 2.15c.; tees, 2.5c. @ 2.6c. and channels and beams, 3.3c.

Railway Track Supplies.—Pittsburgh, Pa. Prices remain unchanged. Spikes, 2c. @ 2.10c., 30 days, delivered; splice bars, 1.80c. @ 1.85c.; track bolts, 2.85c. with square and 2.95c. with hexagon nuts.

Old Material. — There is a fair demand, and no change in prices. No. 1 wrought scrap, $21, net ton; car axles, $26 @ $27; cast scrap, $16, gross; cast borings, $12.50 @ $13; car wheels, $20.

Steel Rails.—New York, $27.50 @ $28. Pittsburgh, $28 @ $28.50. The Vanderbilt system has purchased 17,000 tons for the New York Central and West Shore, 8,500 for the Lake Shore and Pittsburgh & Lake Erie, 6,500 for the Michigan Central, 5,000 for the C. C. C. & I., and 3,000 for the Nickel Plate, a total of 40,000 tons. Three fourths of this, the Western business, went to Pittsburgh and Chicago mills, the former taking the bulk of it.

Bridge Approaches.—The contract for the approach and abutments of the bridge over the Erie canal at Bridge St., Albany, N. Y., has been awarded by JAMES SHANAHAN, Superintendent of Public Works, to Sturtevant & Kellogg, of Sandy Hill, N. Y., at $1,334.75.

Bituminous Pavement.—At Oakland, Cal., the City Trustees have received the following proposals for paving on Washington St.: Bituminous Lime Rock Paving Co.: bituminous rock paving in the roadway, 23.85 cts. per sq. ft.; cement curbing, 85 cts. per lin. ft.; culverts, $3.25 per lin. ft.; flues for manholes, $23.85 each; Essex Paving Co.; 15 cts., 70 cts., $2.70, $35; Pacific Paving Co., grading and covering street with concrete and bituminous rock, 29 cts. per sq. ft., 87½ cts., $3.10, $4.50; Santa Cruz Rock Pavement Co., grading and paving, 31 cts., 80 cts., $37, $2.75.

The Peckham Paper Car Wheel Co., of New York, has issued an interesting and attractive illustrated catalogue of its patented improvements in steel tired paper cored coach and truck wheels, steel tired, wrought and cast car wheels and wrought steel safety tire locks. By this system of independent paper-cored centers, standard duplicate tires and safety tire locks, it is claimed that breakages of wheels and axles from crystallization, inferior material and unsafe tire connections are prevented; railroads can do their own repairs. The wheel centers and tires are interchangeable, and one uniform tire will fit all centers of the same diameter. There are numerous illustrations of wheels, tires, tire locks, etc., also of tire fastenings used in England and Germany.

Dredging.—The following proposals have been received by Col. S. T. ABERT, U. S. Engineer Office, Washington, D. C.: Breton Bay, Md.; Geo. C. Fobes & Co., Baltimore, 14½ cts. per cu. yd.; P. Sanford Ross, Jersey City, N. J., 15 cts.; C. F. Caler, Norfolk, Va., 16 cts.; Baltimore Dredging Co., 16 cts.; American Dredging Co., Philadelphia, 16 cts.; National Dredging Co., Wilmington, Del., 16 cts.; F. C. Somers, Camden, N. J., 18 cts.; T. P. Morgan, Washington, D. C., 18 cts.——York river, Va.; Geo. C. Fobes & Co., 13 cts.; Baltimore Dredging Co., 13½ cts.; American Dredging Co., 13½ cts.; National Dredging Co., 13½ cts.; Morris & Cummings Dredging Co., New York, 13½ cts.; Atlas Dredging Co., Wilmington, Del., 13⅞ cts.; P. Sanford Ross, 13¾ cts.——Mt. Vernon, Va.; Frank C. Somers, 13 cts.; C. F. Caler, 14 cts.; American Dredging Co., 14 cts.; Atlas Dredging Co., 14 cts.; Geo. C. Fobes 16½ cts.; T. P. Morgan, 17½ cts.——Nomini creek, Va.; Thos. P. Morgan, 28 cts.; American Dredging Co., 29½ cts.; C. F. Caler, 29½ cts.; F. C. Somers, 29⅝ cts. All the bids were rejected as too high, and the work is readvertised.

Wire Strands.—The following proposals for furnishing 27,000 ft. of ⅝-in., 24,400 ft. of ½-in. and 27,000 ft. of ⅜-in. wire strands were opened Oct. 25 by Capt. SMITH S. LEACH, U. S. Engineer Office, Memphis, Tenn.: Robt. E. Lee, Memphis, 3.97 cts. per lb. at Memphis reach or Plum Point reach, $1,719.01; Harry E. Coffin Memphis, 4.55 cts. at either place, $1,970.15; Standard Underground Cable Co., Pittsburg, Pa., 6.88 cts. at either place, $2,880; W. W Hite & Co., Louisville, Ky., 4⅞ cts. at either place, $2,111.75; Broderick & Bascom Rope Co., 4 7-10 cts. at either place, $2,025.10; Livermore F. & M. Co., Memphis, 4¾ cts. and 4⅞ cts., $2,092.54. The contract was awarded to R. E. Lee.

Sewers.—*Montgomery, Ala.*—The contract for the sewers has been awarded by the City Engineer, R. M. BOLLING, to Clements Bros., of Cleveland, O., at the following prices; 1,096 ft. of 2 ft.×3 ft. brick, $3 per ft.; 406 ft. of 16×24 brick, $2,60; 5,653 ft. of 18-in. pipe, $1.50; 5,391 ft. of 15-in., $1.10; 6,498 ft. of 12-in., 98 cts.; 909 ft. of 10-in. 80 cts.; 2,374 ft. of 8-in., 60 cts.; rock excavation, $7 per cu. yd.; cradling, $40 per 1,000 ft. B. M.; sheeting left in, $15 per 1,000 ft. B. M.; cement and concrete masonry, $8; extra brick masonry, $20; extra excavation and refilling, 50 cts.; 117 manholes, $45 each, 22 flushing manholes, $75 each; total, $53,943.64. The other proposals were as follows: Howland & Ellis, Boston, Mass., $66,481.71; Metropolitan Construction Co., Boston, Mass., $66,800.62; Figh, Williams & Ball, Montgomery, Ala., $70,473.09.

Asheville, N. C.—The following are the totals of proposals recently received for sewer construction: Jacoby & Madden, Bridgeport, Conn., $26,276; E. F. Fuller, Jersey City, N. J., $29,821.50; B. J. Coyle and G. B. Boren, Washington, D. C., $31,459; J. J. Everson and J. Christy, Jr., Akron, O., $32,655; Dalvigny Sewer Co., Atlanta, Ga., $35,999.50; T. C. Brooks, Jackson, Mich., $40,577.75; John Cox, Brooklyn, N. Y., $46,550.60. The contract was awarded to Jacoby & Madden at the following prices: Earth excavation, not over 6 ft. deep, 23 cts. per cu. yd. for 43,000 cu. yds.; 6 to 12 ft., 12,000 cu. yds., 32 cts.; 12 to 20 ft., 1,500 cu. yds., 55 cts.; 2,200 cu. yds. for manholes, 25 cts.; rock excavation, $2.75 per cu. yd. 1,000 cu. yds. Laying pipe: 13,000 lin. ft. of 20-in., 12 cts. per ft.; 2,500 ft. of 18-in., 10 cts.; 1,900 ft. of 15-in., 10 cts.; 5,200 ft. of 12-in., 8 cts.; 3,900 ft. of 10-in., 7 cts.; 1,450 ft. of 8-in., 6 cts., 33,700 ft. of 6-in., 5 cts. Building 220 manholes, $18 each. All pipe and manhole covers to be furnished by the city. The contract for the castings for manholes was awarded to Asa Snyder & Co., of Richmond, Va., at $7.86 per set, delivered at Asheville. LEE & ASTON, of Asheville, are the Resident Engineers, and T. WM. HARRIS & Co., of New York, are the Consulting Engineers.

Government Work.—***Rubble Stone.***—The following proposals for rubble stone were opened Oct. 31 by Lieut. Col. G. L. GILLESPIE, U. S. Engineer Office, Boston, Mass.: For harbor of refuge, Sandy Bay, Mass.; Rockport & Pigeon Hill Granite Co., Rockport, Mass., 71 cts. per ton of 2,000 lbs.; Chas. H. Edwards, Boston, 76.9 cts.—For Newburyport harbor, Mass.; Rockport & Pigeon Hill Granite Co., $1.97 per ton of 2,000 lbs.; Edwin Canney, Rockport, $1.99; Cape Ann Granite Co., Boston, $2.13; Geo. W. Andrews, Biddeford, Me., $2.17; Chas. H Edwards, Boston, $2.19; Thomas A. Rowe, Boston, $2.37

Breakwater.—The following proposals for 400 ft. of substructure of breakwater in Milwaukee bay were opened Oct. 31 by Major CHAS. E. L. B. DAVIS, U. S. Engineer Office, Milwaukee, Wis.: Christopher H. Starke, Milwaukee; 561,360 ft. B. M. of pine timber, $15 per M.; 25,000 ft. B. M. of pine plank, $14 per M.; 2,100 ft. B. M. of 1-in. pine boards, in work, $20 per M.; 57,800 lbs. of iron drift bolts, 3 cts. per lb.; 1,250 lbs. of iron screw bolts, nuts and washers, 4 cts.; 2,000 lbs. of iron spikes, 4 cts.; 4,100 cords of stone, $7 per cord; 561,360 ft. B. M. framing timber, including placing, sinking, filling cribs, etc., $8 per M.; 25,000 ft. B. M. laying plank, $5 per M.; taking up plank, $5 per M.; total, $43,992.28. Knapp & Gillen, Racine, Wis.; pine timber, plank and boards, $16.75, $13.50 and $15 per M.; iron drift bolts, screw bolts and spikes, 3 cts., 4½ cts. and 4½ cts. per lb.; stone, $7.40 per cord; framing timber, $7.25 per M.; laying and taking up plank, $5 per M.; total, $46,186.89. Truman & Cooper, Manitowoc, Wis.; timber, plank and boards, $17, $15 and $19; iron, 3½, 6 and 5 cts.; stone, $7.50; framing, $8; laying and taking up plank, $6; total, $47,546.90. Charles Berner, Green Bay, Wis.; timber, pine and plank, $16, $16 and $20; iron, 3½, 5 and 4 cts.; stone, $8; framing, $8; laying and taking up plank, $4; total, $48,980.14. Hiero B. Herr & Co., Chicago, Ill.; timber, plank and boards, $19, $16 and $14; iron, 4 cts., 5 cts. and 5 cts.; stone, $8.25; framing, $8.50; laying plank, $7; total, $52,341.30. The contract was awarded to Christopher H. Starke.

Dredging.—***Plattsburg Harbor, N. Y.***—The following proposals have been received by Major M. B. ADAMS, U. S. Engineer Office, Burlington, Vt.: Luther Whitney, Keeseville, N. Y., 13 cts. per cu. yd., $3,640; Wm. James Daly, Ogdensburg, N. Y., 16 cts., $4,480; Willard Johnson, Fulton, N. Y., 24 cts., $6,720.

Lake Champlain, Vermont.—The following proposals for dredging the channel between North Hero and South Hero islands, have been received by Major M. B. ADAMS, U. S. Engineer Office, Burlington, Vt.; Wm. James Daly, Ogdensburg, N. Y., 49 cts., $7,984; Luther Whitney, Keeseville, N. Y., $1.49 for boulders and gravel, 25 cts., for clay and gravel, $12,680; Willard Johnson, Fulton, N. Y., $2.75 for boulders and gravel, 27 cts. for clay and gravel, $21,680.

Indian River, Delaware.—The following proposals for dredging a channel between Assanoman bay and Indian river were opened Nov. 2, by Gen. W. SMITH, U. S. Engineer office, Wilmington, Del.; Lemuel E. Miller, Cape May, N. J., 21½ cts. per cu. yd.; Atlas Dredging Co., Wilmington, Del., 24 cts.; P. Sanford Ross, Jersey City, N. J., 25½ cts.; Frank C. Somers, Camden, N. J., 30 cts.; American Dredging Co., Philadelphia, Pa., 34 cts.; Baltimore Dredging Co., Baltimore, Md., 36 cts.

Missillion Creek, Delaware.—The following proposals were opened Nov. 2 by Gen. WM. F. SMITH, U. S. Engineer Office, Wilmington, Del.: American Dredging Co., 30 cts. per cu. yd. in bucket or 38 cts. in place; Frank C. Somers, Camden, N. J., 35 cts.; Atlas Dredging Co., 35½ cts.

Ipswich River, Massachusetts.—The following proposal was opened Nov. 1 by Lt. Col. G. L. GILLESPIE, U. S. Engineer Office, Boston, Mass.: Thomas Symonds, Leominster, Mass., $1.25 and 40 cts. for above and below Heards Point; $15 for removal of boulders weighing over 2 tons.

Plymouth Harbor, Massachusetts.—The following proposals were opened Nov. 1 by Lt. Col. G. L. GILLESPIE, at Boston: A. R. Wright, Portland, Me., 29¾ cts. for dredging, scow measurement, $10 for rock over 3 tons in situ; Boynton Bros., Boston, 32 cts., $12; National Dredging Co., Wilmington, Del., 30 cts. for dredging; Bay State Dredging Co., Boston, 35 cts. for dredging.

Gloucester Harbor, Massachusetts.—The following proposals for dredging and blasting were opened Oct. 31, by Lt. Col. G. L. GILLESPIE, at Boston: Thomas Symonds, Leominster, 40 cts. per cu. yd. in scow for dredging, $35 per cu. yd. in situ for rock; Geo. W. Townsend, Boston, $30 for rock, $15 per cu. yd. for loose material, measured by water displacement; H. M. Sargent & John F. Hamilton, Portland, Me., $32 for rock, $1.50 for loose material; Bay State Dredging Co., Boston, 30 cts. for dredging; Hiram W. Phillips, Quincy Point, Mass., $28 for rock, $6 for loose material; New England Dredging Co., Boston, 34 cts. for dredging.

Superior Bay, Wisconsin.—The following proposals for dredging in Superior and St. Louis Bays, Wisconsin, and Grand Marais, Minn., were opened Oct. 29 by Major J. B. QUINN, U. S. Engineer Office, Duluth, Minn.: Greens Dredging Co., Chicago, Ill., 24½ cts. per cu. yd. for Wisconsin work, 27½ cts. for Minnesota work; Williams, Upham & Co., Duluth, Minn., 14½ cts., 21 cts.; Charles S. Barker, Duluth, Minn., 14 cts., 26 cts.; Knapp & Gillen, Racine, Wis., 19 cts., 29 cts.

WATER.

South Barracas, Argentine Republic.—The South Barracas Gas Co. has been incorporated in London to acquire concessions granted by the municipality of South Barracas for the construction of gas works, water-works, sewerage works, etc. Capital stock, $500,000. J. C. SIMPSON, C. E., of Broadway Chambers, London, is the engineer of the company.

Drainage.—The Massachusetts State Board of Health has completed the report for a plan to drain the Mystic and Charles river valley, which interests 300,000 people in a rapidly growing district. The system will cost nearly $4,000,000, and will drain every acre of the territory.

The Pecos Irrigation & Investment Co. has been incorporated, with a capital stock of $600,000, to construct a canal from a point on the Rio Pecos, in New Mexico, 10 miles south of Seven Rivers (11 miles of which are already constructed), and to utilize the water of the Hondo and Spring rivers, near Roswell. It proposes to utilize all of the unappropriated water of the river and to that end will construct the upper canal from the Hondo, 30 ft. wide at the bottom and 5 ft. deep, a distance of some 25 miles, and will enlarge the lower one to 45 ft. wide at bottom and 6 ft. deep, with a total length of 30 or 40 miles. By careful measurement it is found that the river furnishes a never failing supply of water to irrigate 200,000 acres of land, and the land that may be covered is quite double that number of acres. President Gen. L. B. BRADLEY; Vice-President, CHAS. B. EDDY; Treasurer, G. B. SHAW, of the Metropolitan National Bank, Chicago; Secretary and Manager, CHAS. W. GREEN; Superintendent, PAT. F. GARRETT.

Sao Paulo, Brazil.—The Cantareira Water Supply & Drainage Co. has been advertising in London the issue of $1,750,000 five per cent. debenture bonds (second issue.) The company, which has a capital of $2,812,500 of which $1,539,380 is paid up, was founded in June, 1877, for draining and supplying water to the city of Sao Paulo, and the present issue is to provide for paying off a loan and for extending the works. The city is the capital of the province of Sao Paulo; in 1878 the population was estimated at 25,000 and the number of houses at about 3,000, while in 1887 the population was estimated at 50,000 and the number of houses at 9,000; of this latter number 6,900 houses are within the company's water and drainage system. 4,732 have drainage connection and 3,915 are supplied with water. The water is said to be of good quality and the reservoirs and water-works well built. Dr. RAFAEL AGUIAR PAES DE BARROS is President of the company.

Portland, Ore.—County Surveyor THOMAS H. HURLBURT has submitted his report of his investigation of Bull Run, Portland's future water supply. The stream flows from a lake about 2 miles long by ¾ mile wide, 8 miles northwest of Mt. Hood, and is 3,000 ft. above sea level. It drains an area of about 150 sq. miles and is said to be of excellent quality. The following is an approximate estimate of the discharge per 24 hours:

	Gals.
From the lake	25,000,000
From south fork, 5 miles below the lake	8,000,000
From north fork, 15 miles below lake	12,000,000
From south fork, 20 miles below lake	11,000,000
From small streams	9,000,000
Total	65,000,000

Nashville, Tenn.—Superintendent GEORGE REYER has filed his annual report for the year ending Sept. 30, 1888. The distributing system is being improved continually by replacing the 3 and 4 in. pipe with pipe of larger diameter. This work will have to be continued until all of this small pipe, in the center of the city, has been removed and pipe large enough to insure a full supply, not only for ordinary use, but for fire purposes also, has been laid in its place. Considerable of the old pipe now in use was cast horizontal and is not of uniform thickness. Some that has been examined was found not over ⅛-in. thick. It is probable that when the new reservoir is brought into service there will be trouble with some of this pipe. During the year 14,494 ft. of pipe were laid and 3,112 ft. abandoned; total now in use, 235,998 ft. Total pumpage by the Worthington engines 3,209,323,486 galls. Meters are only used for large consumers and even with these large meters considerable trouble is experienced by the parts wearing and becoming clogged. When the new works are started and the filter is brought into service this trouble may be averted and it may become necessary to largely increase the number of meters in order to check waste. The new pumping station will soon be ready for service; in it will be a Holly compound, condensing, duplex engine guaranteed to pump 10,000,000 galls. per day through 7,000 ft. of 36-in. mains. The present machinery cannot be operated when the new works are completed and the Superintendent recommends the purchase of another engine.

Syracuse, N. Y.—The Syracuse Water Co. has notified the city that its experiments with the gang well system at Onondaga Valley have resulted successfully and that it proposes to adopt this as a source of supply; the city is asked to approve the system in order that the necessary land may be condemned. A permanent pumping station is to be erected and a 36-in. main laid to connect the wells with the city distribution system. For over 6 weeks the company pumped from 32 wells with a daily capacity of 10,000,000 galls.

Brooklyn, N. Y.—The 20 proposals received recently for $500,000 of 3 per cent. water bonds, ranged from par to $1.06 3-8, at which latter figure they were awarded to Vermilye & Co., of New York.

Drainage.—County Drain Commissioner JAS. A. STEVENS, of Detroit, Mich., has submitted his annual report. The commissioner reported that there were 21 drains under contract to be completed this fall comprising a total of 10,921 rods. Of this 1,151 are new drains and 9,770 were repairs and dredging. This work would be completed at a cost of $9,788.85.

Water Power.—The Gothenburg Canal Co. has been incorporated at Lincoln, Neb., to construct a canal and lake for furnishing water power to manufacturers. Capital stock, $25,000. F. M. SPRINGSTEEN, BOONE KELLEY, J. R. HOLCOMB, H. C. BARKER, and others.—The Oxford Manufacturing & Improvement Co. has been incorporated at Oxford, Neb., to build a dam on the Republican river and dig a canal from the river to the town for furnishing water power. Capital stock, $10,000.

Jersey City, N. J.—It is stated that in consequence of the pollution of the water supply, Hoboken, which paid $90,000 a year, has withdrawn and has made a contract with a private company for better water; Bayonne, also, which pays $40,000 a year for water will also cease taking a supply when the present contract expires; it is also said that the sugar works, paying $30,000, and the railroad companies, paying $70,000 to $80,000, will contract with private parties for better water. The city proposed to stop this by refusing to allow the necessary mains to be laid, but the Corporation Council has stated that the railways can lay mains on their right of way, which would thus enable them to act independently of the city authorities as all the roads have a right of way through the city.

Green Island, N. Y.—The new water-works are now in operation. The old source of supply was the Mohawk river, and the water was pumped to a reservoir in Watervliet, back of West Troy. The old plant was operated by the West Troy Water-Works Co. until last spring, when it was purchased by the new Green Island Water Co., organized by Moffet, Hodgkins & Clarke, of Watertown, N. Y., (no local capital being interested), and the company utilized the old mains and reservoir but discarded the old pumping station. The same firm built the works at Waterford and Greenbush, in both of which places the water is pumped to a tank. At Green Island the water is pumped to the reservoir or direct into the mains; ordinary pressure, 60 lbs; fire pressure, 80 to 100 lbs. The receiving station is on Gravel Id., where is the filter gallery, 18 ft. below the ground; the gallery is open at the bottom to allow the water to filter through, has walled sides and roof, and is 160 ft. long. There are 2 pumping engines of 2,500,000 galls. daily capacity each; and two 90 H. P. boilers, built by Pinkerton of Green Id. E. C. COOK is Superintendent of Construction, and O. W. WEED Superintendent.

Berlin, Ont.—The water-works have been completed and were tested Oct. 18, with satisfactory results. About four years ago experiments were made with an artesian well, but the water was brackish and not fit for use. In 1887 the City Council advertised in ENGINEERING NEWS for proposals for the construction of works on the franchise plan. Several propositions were received and the work was let to Moffett, Hodgkins & Clarke, of Watertown, N. Y. There are about 9 miles of cast-iron mains; a 12-in. force main from the lake; 65 hydrants, and a steel stand-pipe 16 ft. in diameter and 104 ft. high, located on a hill 94 ft. above the lake and 50 or 60 ft. above the city. The pumping plant consists of two Worthington engines with a daily capacity of about 2,000,000 galls., with two steel tubular boilers, 14 ft. by 5 ft. The water is pumped from a large brick collecting well into which several springs flow, and there is a connection with the lake for an emergency supply. At the test, six fire streams were thrown to a distance of 145 ft., equal to a height of 110 ft. The works have been favorably reported on by HERBERT J. BOWMAN, C. E., of Berlin. E. B. CALKINS was the company's Superintendent, and C. T. TAYLOR, the Engineer of Construction.

Irrigation.—***Colorado.***—The Denver Water & Reservoir Co. has been incorporated by JOHN P. MARSTON, T. W. HERR, and HENRY O'DONNELL to collect water from Clear, Bear and Turkey creeks and Platte river into a reservoir and to pipe it to Denver for irrigation and domestic purposes. The Maston lakes will be used as a reservoir.—The Grand River Canal Co. has been incorporated by J. G. PATTERSON, RODNEY DENNIS and SYLVESTER C. DUNHAM, of Hartford, Conn., with office at Denver, and has purchased all the rights of the Grand River Ditch Co. with all the canals and ditches between Grand river and the Western State line. Capital stock, $50,000. The Monte Vista Canal Co. has been incorporated by the same persons, together with C. H. TOLL and J. F. BRONK, of Denver; the company will acquire the rights of the Citizens Ditch Co. in Rio Grande and Conejos

counties. Water is taken from the Rio Grande. Capital stock, $100,000.——The West Elk Ditch Co. has been incorporated by J. B. MANSFIELD, T. D. RAYNER and W. P. MANSFIELD. The source of the principal ditch is at the two west branches of West Elk creek, in Garfield county. Capital stock, $5,000.

Washington Territory.—The Yakima Irrigating & Improvement Co., of Tacoma, has been incorporated by I. W. DUDLEY, H. S. HUSON, and A. A. KNIGHT, of Tacoma, and F. A. DUDLEY, of Niagara Falls, N. Y. Capital stock, $400,000.

Artesian Wells.—*Roanoke, Va.*—Several wells will be put down by the Norfolk & Western R. R. Co.

Virginia Beach, Va.—The improvement company will put down a well 600 ft. deep.

Savannah, Ga.—The 18 wells now flow 6,500,000 galls. per day.

Charleston, S. C.—The new artesian well is now down 1,616 ft. and is 7 ins. diameter.

Augusta, Ga.—An artesian well will be put down at the U. S. Arsenal and $10,000 have been appropriated for the purpose. Address Major J. W. RIELLY.

Uniontown, Ala.—An artesian well will be put down by a New York firm.

Alexandria, La.—The artesian well is now down 150 ft.

Monticello, Ill.—A well has struck water at a depth of 200 ft. and the flow reaches 5 ft. above the ground. The water will be used for a supply for water-works.

Osceola, Ia.—The well is to be continued to a depth of 3,000 ft.

Nevada, Mo.—A good flow of water was struck at a depth of 640 ft.

Santa Ana, Cal.—The experimental well struck water at a depth of 312 ft.

Dallas, Tex.—A well for the Dallas Bagging & Cordage Co. will be put down by J. W. Byrnes & Co.; their contract price is $6,000.

Water-Works.—*Massachusetts.*—Marblehead. Extensions of the water system are proposed, to cost $4,200. —Easthampton. The committee having charge of the new water-works have negotiated a loan of $15,000 at 4½ per cent. with the savings bank, in order to carry on their work. The foundation of the reservoir has been laid and also considerable pipe.——Athol. The proposition to take water from Phillipston pond is still unsettled.

New York.—Waterford. The Waterford Water-Co. has elected MORTON C. POWELL, President, and GEO. E. HOLROYD, Vice President. CHAS. C. ORMSBY succeeds J. C. PLATT as Trustee.——Avon. The water-works were put in operation on Oct. 31. The supply is by gravity from Conesus Lake, and there is a reservoir with a capacity of 500,000 galls.

Pennsylvania.—Cambria. The Morrellville & Cambria Water Co. has been incorporated by JOHN DOWLING and others; capital stock, $50,000.——Wilkesbarre. The Keystone Water Co. has been incorporated by S. L. BROWN and others; capital stock, $5,000.——Scranton. The Bellevue Water Co. has been incorporated by J. C. VAUGHN and others; capital stock $20,000. The Renham Water Co. has been incorporated by L. AMERMAN and others; capital stock, $10,000.——Moscow. The Moscow Water Co. has been incorporated by O. E. VAUGHN, and others; capital stock, $100,000.

Tennessee.—Nashville. It is expected that the city wil have a supply of filtered water in January.

Mississippi.—Greenville. The contractors for the Greenville Water-Works Co. have struck water at a depth of 400 ft.

Michigan.—Marshall. The City Council has awarded the contract for a system of water-works to Moffett, Hodgkins & Clarke, of Watertown, N. Y.; the building will be commenced at once, but pipe will not be laid until spring. There will be 8 miles of pipe and 90 hydrants.

Illinois.—Norwood Park. The contract for the construction of water-works has been awarded to Geo. C. Morgan, C. E., of Chicago.

Minnesota.—Duluth. The question of the forfeiture of the charter of the water and gas company was discussed at a recent council meeting, and it was decided that as the company was making extensive improvements it should not be interfered with.

Missouri. Washington. The Interstate Gas & Water-Works Co. has received its filter from Concord, Conn.; it will be placed just west of the pump house, and near the settling basin. When set and put into operation it will have cost the company $3,000.

Kansas.—Wichita. During October the Wichita Water-Works Co. laid 2½ miles of pipe and is at work on extensions to Riverside, Garfield University and College Hill. M. AMSBARRY is Superintendent.

Colorado.—Montrose. The new water-works will be on the direct pressure system and will cost about $22,000. The Denver Steam Pump Co. will furnish the pumping plant.

Montana.—Helena. The East Side Water Co. has made a proposition to supply water to the city and to guarantee a pressure sufficient for fire purposes.

Texas.—Galveston. Pipe and castings are being delivered. Well No. 6 is completed, and is flowing satisfactorily.——Corpus Christi. The location of the well and water-works has been decided upon. The well will be sunk by the American Well Co., of Aurora, Ill., starting with a 12-in pipe, the guarantee being a flowing well of certain quantity and quality.

Canada.—Tilbury, Ont. The new water-works were tested, with satisfactory results, on Oct. 22.——Chatham Ont. The water-works question is still occasionally taken up, but no definite action has been taken by the Water Committee of the council.

The Westinghouse Electric Co., of Pittsburg, Pa., has been awarded the contract for a central station plant in London, England. The contract calls for 25,000 16 c. p. incandescent lamps. The company has purchased almost the entire capital stock of the Waterhouse Electric & Mfg. Co., of Hartford, Conn., thus obtaining a large interest in the arc light business, as the Hartford company has now over 3,000 lights in use.

Drainage in Illinois.—The commissioners of the great Lake Park drainage district, at Monticello, have ordered further enlargement of the large ditch which runs through the counties of Champaign, Platt and Douglas. The late freshet overflowed the ditch. They propose to make the ditch 12 ft. deep and 14 ft. wide at the bottom and 30 ft. wide at the top; also to open up an additional ditch. The main ditch and laterals have now cost $175,000. The entire cost will reach $200,000.

The Niagara River Hydraulic Motor & Power Co. is the new title of the company at East St. Louis, Ill., formerly known as the Niagara Falls Hydraulic Motor & Power Co. The company has reduced its capital stock.

The Mussel Slough Canal Co. has been incorporated to construct canals in Tulare and Fresno counties, Cal., for irrigation and manufacturing purposes. Capital stock, $200,000. The Directors are CHAS. L. LIND, GEORGE H. MALTER, FRANKLIN P. BULL, and LEE W. MIX, of San Francisco, and WILLIAM H. JORDAN, of Oakland.

The New York Electric Pneumatic Tube Co. has been incorporated at Albany, N. Y., by G. CALHOUN and JOSEPH B. WILSON, of Brooklyn, N. Y., and others. Capital stock, $100,000.

Natural Gas.—The Killback Gas & Oil Co., of Madison Co., Ind., has been incorporated to prospect for natural gas and oil. Capital stock, $5,000.

Special Reports of Water-Works Construction.

THE ENGINEERING NEWS MANUAL OF AMERICAN WATER-WORKS is now being compiled, and will be *indispensable* to every manufacturer, engineer and contractor in any way interested in Water-Works construction and maintenance, and will be of great value to Water-Works superintendents and projectors of new works.

Superintendents of water-works and water companies will wish to see correct and complete data concerning their Works in our MANUAL, and to ensure this they should send in reports *at once* upon the blanks which we have already sent to every Water-Works office in the United States and Canada. Many have delayed their report, and if the blanks we intended for them have been lost in the mail, or mislaid, we will send more upon request.

We *must* have a report from every public water supply system in North America, so those who reply to our inquiries at once will save a second inquiry. We also wish to know of *every* new Water-Works plant in process of construction, and of *every* new project in this line. We will send to any one desiring them, blanks upon which reports can be made.

Further details of the MANUAL will be advertised later. We abstract from our special reports for the MANUAL the following items of current interest:

CENTREVILLE, Md., Nov. 1, 1888.

EDITOR ENGINEERING NEWS:—The town proposes to sink an artesian well and pump from it to stand-pipe, the system to cost about $15,000 and to be met by bonds. Population, 1,800.

Regarding the above D. C. HOPPER writes that the town voted to have works several months ago, and that W. F. HARMAN can give information.

HARRISONBURG, Va., NOV. 1888.

EDITOR ENGINEERING NEWS:—Water-works are now being built in our town. R. D. Wood & Co., Philadelphia, Pa., are the contractors. WM. H. RITMAN.

WARRENTOWN, Va., Oct. 31, 1888.

EDITOR ENGINEERING NEWS:—The citizens of this town want water-works badly. I refer you to R. R. CAMPBELL.

HINTON, W. Va., Oct. 28, 1888.

EDITOR ENGINEERING NEWS:—We have no water-works, but for some time have been trying to negotiate to have them built. Have made but little progress.

JAS. PRINCE, *Recorder.*

CALERA, Ala., Oct. 29, 1888.

EDITOR ENGINEERING NEWS:—An attempt to build water-works has been made. J. R. ADAMS, Montgomery, Ala., can give information. W. M. D.

UNIONTOWN, Ala., Oct. 29, 1888.

EDITOR ENGINEERING NEWS:—Our city fathers are discussing the boring of a well. Address J. C. WELCH, Mayor. J. J. BROWN.

JOHNSON CITY, Tenn., Nov., 1, 1888.

EDITOR ENGINEERING NEWS:—The population of Johnson City is something over 3,000. I have bought a large spring to supply the town with water, which will furnish about 1,000,000 galls. every 24 hours. It is situated 3 miles from the center of town, and I have the site bought for a reservoir one-half mile from center of town. My reservoir will be 22 ft. below head of spring, and 143 ft. above the street curbs, making the spring 165 ft. above town. I have commenced the reservoir, but am holding up now for the town council to agree to take a certain number of fire plugs for a term of years. At all events I shall begin the work soon and shall build it with money, or turn over a certain amount of bonds to some contractor to finish the job from beginning to completion. In the meantime I shall be glad to hear from contractors. Shall put in 12-in. pipe the whole distance.

F. A. STRATTON.

KANSAS CITY, Mo., Nov. 3, 1888.

EDITOR ENGINEERING NEWS:—I am now making plans for water-works at Osborne, Kan., some 4 miles of pipe and stand-pipe. The water-works for the Government at Ft. Riley, Kan., now being built by Pearsons & Dwyer, are nearly completed. I will describe them, when done. At Birmingham, Ala., the water-works company is laying 8 miles of 30-in. pipe with Worthington high duty engines lifting the water 400 ft. A reservoir will be built in a valley on the mountain, with a capacity of 100,000,000 galls.

G. W. PEARSONS.

RIPON, Wis., Oct. 27, 1888.

EDITOR ENGINEERING NEWS:—The Council have been trying to put in works but have not succeeded.

CARTERSVILLE, Mo., Nov. 2, 1888.

EDITOR ENGINEERING NEWS:—There is some talk of building water-works here. Address W. A. DOUGHERTY.

R. E. WARNMER.

ROSEBURGH, Ore., Oct. 30, 1888.

EDITOR ENGINEERING NEWS:—Address G. W. KIMBALL or N. P. BENNETT for information regarding the proposed water-works for this place. ROSEBURGH.

RECORD OF NEW WATER-WORKS CONSTRUCTION.

(Specially Communicated).

CONTINUED FROM PAGE 358.

Redlands, Cal.—The works were commenced in April, 1887, and completed March 1, 1888; they supply Redlands, Lugonia and Crafton. They were designed by E. A. TUTTLE, C. E., of Redlands, who was also Constructing Engineer. The construction was done by days work under the supervision of the superintendent and engineer. In September there were 24 miles of pipe laid and in operation, but the distributing reservoir was not complete. The valves were furnished by Crane Bros. & Co., of Chicago, Ill. The supply is taken from Bear Valley reservoir, Santa Ana river, Mill Creek canon, and flows by gravity through open ditches to the distributing reservoir, which will be 175 ft. by 400 ft. and 19 ft. deep. There are 24 miles of pipe and 250 taps; the mains are of wrought and sheet iron; the service pipes are of wrought-iron. Average daily consumption, 450,000 galls. Ordinary pressure, 80 lbs.; fire pressure, 104 lbs. Cost of works, $80,000; cost of water, $120,000; total, $200,000. Annual operating expenses, $3,000. Annual revenue, $6,000 from consumers, none from city. The works are owned by the Redlands, Lugonia & Crafton Domestic Water Co.; President, GEO. A. COOK; Secretary, F. G. FERAUD; Superintendent, H. W. ALLEN. Capital stock, $500,000; $200,000 paid up. The company also supplies water for irrigation. The present population is 1,500. (Date of special report; September 29, 1888).

Inglewood, Cal.—The works were commenced in November, 1887, and completed in May, 1888. They were designed by WM. HAM. HALL, of Sacramento, Cal., and C. H. KLUEGEL, of Ontario, Cal., was the Constructing Engineer. The contract for pumping machinery was let to A. L. Fish, 30 First St., San Francisco, Cal., and for pipe, specials, valves, hydrants and pipe laying to Lacy, Ward & Co., of Los Angeles. The supply is taken from Inglewood Springs, developed by excavations and artesian borings; the flow is 1,000,000 galls. per 24 hours, used partly for irrigation. The reservoir has a capacity of 500,000 galls. There is a Worthington pump with a daily capacity of 900,000 galls. There are 15 miles of pipe; the mains are of riveted and screw pipe, dipped, and the services are of screw pipe. Ordinary pressure averages 90 ft. Cost of works, $39,000. The works are owned by the Centinela-Inglewood Land Co.; President, L. A. SHELDON; Secretary, E. J. COX; Superintendent, A. M. ROLLINS. The present population is 400.

Sandy Hill, N. Y.—In correction of our description of these works, on page 358, the Eddy Valve Co., of Waterford, N. Y., writes us that the Eddy valves were used.

(TO BE CONTINUED.)